THE CONDOR

A Bi-monthly Magazine of Western Ornithology

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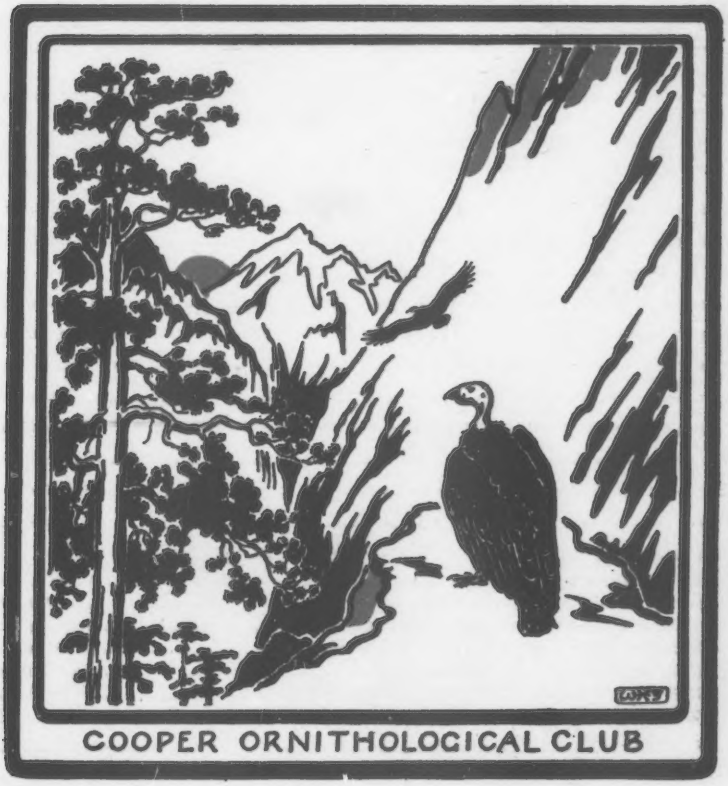

COOPER ORNITHOLOGICAL CLUB

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A Magazine of Western Ornithology

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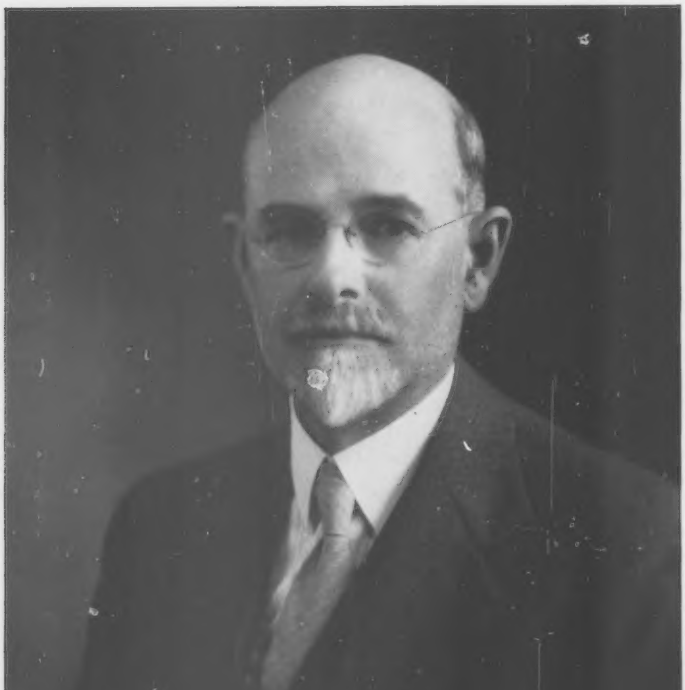

THE CONDOR, *January, 1940*
Photograph by Webb

JOSEPH GRINNELL IN 1932

UNIV. OF MICH.

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THE CONDOR

VOLUME XLII JANUARY-FEBRUARY, 1940 NUMBER 1

JOSEPH GRINNELL: 1877-1939

WITH FRONTISPIECE AND ELEVEN OTHER ILLUSTRATIONS

By HILDA WOOD GRINNELL

Joseph Grinnell was born on February 27, 1877, at the Kiowa, Comanche, and Wichita Indian Agency on the Washita River, forty miles from old Fort Sill, Indian Territory, son of the agency physician.

His father was Fordyce Grinnell, M.D., a birthright member of the Society of Friends and second son of Jeremiah Austin Grinnell, minister of note among the Friends of Vermont and Iowa, and later of California. As were his distant cousins, George Bird Grinnell, and Joseph Grinnell of New Bedford, Fordyce Grinnell was descended from Matthew Grenelle, a French Huguenot who was admitted as an inhabitant of Newport, Rhode Island, May 20, 1638.

His mother was Sarah Elizabeth Pratt, also a birthright Quaker, whose father, too, was a minister, Joseph Howland Pratt of Maine and New Hampshire. Both of Joseph Grinnell's parents were descended from "early-come-overs." Frances Cooke, John Alden, and Richard Warren of the Mayflower, Henry Howland, who followed his brother John to the new land, Thomas Taber, and the Worths of Nantucket were among their progenitors. New England traits of character were Joseph Grinnell's heritage.

Fordyce Grinnell as a young physician soon left the Indian service for two years of private practice in Marysville, Tennessee, but he was restless for the prairies. 1880 found him again in the service, this time in the Dakotas, where Chief Red Cloud's people were gathered. Here the family circle was completed by the birth of a second son, Fordyce, Jr., at Pine Ridge Agency, and a daughter, Elizabeth, at Rosebud. Being the eldest, however, by five years, Joseph relied upon Indian companions for playmates. Undoubtedly his senses were quickened by association with these alert comrades. The well-trained ear and quick eye which in later years made the fine field naturalist received in the Dakotas their first conscious training.

Chief Red Cloud's folk were Oglala Sioux, said to be the finest of the Plains Indians. Honesty of thought and action was as much a rule of life in the Indian village as it was in the Quaker home. A stick placed against the closed flap of a tepee to indicate the owner's absence made all articles within safe from molestation. The energetic small boy was a favorite with Chief Red Cloud and when, in later years, he dictated letters to the Grinnells in Pasadena there was always an especial greeting for "my little friend Joe."

In 1885 the family home was established in Pasadena, California, and eight-year-old Joe's formal education was begun in the "Central School," which occupied a five-acre site on Colorado Street between Raymond and Fair Oaks avenues. Late in 1888 came the collapse of southern California's "boom," and with the collapse hard times for everyone. Just at this time there came the offer of the post of resident physician at the Indian school at Carlisle, Pennsylvania. Dr. Grinnell thankfully accepted the offer and the family went east to Carlisle, where the school was under the command of an old Army friend, Captain Richard Henry Pratt. Here Dr. Grinnell was content, for he loved the work

among his Indian charges and the complete freedom from financial responsibility which a stated salary gave him. His wife, however, pined for California's sunshine, so at the end of two years the family returned to the home on north Marengo Avenue, Pasadena, christened "The Birds' Retreat." The name was well chosen, for as the years went by and tall cypress hedges shut out the street, vines, fig trees, and huge clumps of pampas grass grew up, making the hospitable home a veritable bird sanctuary.

Joe brought back from Carlisle a cotton-stuffed toad, the first specimen in his collection, and a love for printer's ink. During his second summer in Carlisle he had worked in a printing shop. The insight there gained into printers' problems later won him the friendship of Charles A. Nace, the Cooper Club's first printer.

In 1893 Joseph was graduated from the Pasadena High School, at the age of sixteen. Shortly thereafter he went on his first real field trip, with a fellow graduate, Robert Louthian by name. The boys took a pack burro with them and their letters home told of penetrating "isolated regions" as far away as Simi Valley, Ventura County.

Enrollment in the college division of Throop Polytechnic Institute followed the summer's vacation. Alfred James McClatchie was in charge of the courses in biology and under this able botanist the boy received careful scientific training.

In 1895 Dr. Hiram A. Reid published his "History of Pasadena," a carefully compiled work of nearly seven hundred pages. Included is a list of the birds of Pasadena by "Joseph Grinnell, Student at Throop Institute." Of the eighteen-year old boy Dr. Reid says: "Young Joseph Grinnell, son of Dr. Fordyce Grinnell, has won the reputation of having captured, preserved, labeled and classified more specimens of our native birds than any other person. He seems to have a specimen of every species and variety of avian fauna ever found here, all nicely preserved, and neatly labeled with both its common and its scientific name." The names were those of Coues' Key, edition of 1892, a copy of this invaluable book having been presented to the young bird student by his parents in December of 1893. The list included the names of one hundred and fifty-eight species of land birds which had been identified within a radius of eight miles of Pasadena.

In the spring of 1896 Captain Pratt was detailed to make an inspection of the Indian Schools on the Pacific coast as far north as Sitka, Alaska. Stopping in Pasadena to see the Grinnells, he suggested that Joseph be permitted to accompany him north. This suggestion was received with so much enthusiasm by Joseph himself that all parental doubts as to the advisability of the trip were dispelled and we find him writing from San Francisco on Saturday, May 23, 1896: "Dear Folkses; I'm having a high old time here. We got in Thursday night and I put up at the Grand Hotel; Captain and Nana are across the street at the Palace Hotel. Friday forenoon I went collecting down to the end of the Bay about 16 miles out of town, & got 15 nice birds. . . ." At the Chemawa Indian School, near Salem, Oregon, he collected also, mailing home a box of birds with the request that his good friend Frank S. Daggett be asked to unpack the box and re-set the skins.

At Sitka, Captain Pratt and his daughter turned homeward, but Joe decided to stay on as long as he could make his money last. His enthusiasm for birds happily won him the friendship of Mr. Frobesee, in charge of the Mission paint shop and, in the absence of Dr. Jackson, the Sheldon Jackson Museum. There was on the Mission grounds a vacant house, partly furnished, and at Mr. Frobesee's request Joe was allowed the use of it. Later Mr. Frobesee paid him $1.50 weekly to assist in the Museum on "boat day" each week, for even in 1896 many tourists visited Alaska in the summertime.

Gaily Joe wrote home: "I have started in on my bill of fare for the summer — Two hard-tack with *Jelly* on. for breakfast, *Jelly* with two hard-tack on for dinner; and I

will get supper in town at a chinaman's resturant [*sic*], for 30c a meal or $9.00 a month, which is very cheap." This seems scanty fare for a growing lad, so we are relieved to find him writing a few weeks later: "I have fine company now—A Prof. and Mrs. Hindshaw from the University of Washington who are collecting plants, birds, bugs, & everything else. They use two rooms in my house as work-shop. . . . We get up great meals I tell you. My! but the spread we had last night! Flapjacks! 16 Plover roasted in a Dutch Oven, the finest meat I ever tasted; Venison, Salmon, etc. And after supper we went a few yards back of the house and picked all the Huckle-berries and Salmon-berries we could eat, and plenty for pies.... It is very pretty weather here now. I never was so well and happy in my life. Think of it! In a new country, collecting new birds every day. It's my ideal of a good time. Fishing, boating, all I want, with lots of adventures. . . ." Some of the adventures were on trips up the rocky coast, or many miles out to sea with Indian companions, in Indian canoes. On one such trip he was left overnight, through a misunderstanding, twenty miles out on lonely St. Lazaria Island, without food or blankets. That night he learned much of the ways of Petrels, as recounted in the "Nidologist" (vol. IV, March, 1897, pp. 76-78).

One adventure occurred on a day when, with Professor Hindshaw, he was out sailing on the bay. "We were sailing along finely, among the beautiful islands which dot the bay, when suddenly there was a terrific roar, and not one hundred yards to our left, a gigantic whale rose out of the water, blowing up a stream of water, which sounded like our fire-engine. After dashing the water into foam with his tail he disappeared, and to our horror he immediately appeared on the other side! he had gone right under our boat. This time he turned and dirrected [*sic*] toward us! My we were scared. We didn't have any wits left. I was never really frightened before. We stood with our guns cocked, we didn't know why, as the whale dove out of sight toward us; we thought every moment he would rise under us, and dash our boat to atoms. But after what seemed hours of waiting, he rose, far ahead, swimming away from us, and we made for a shallow inlet."

Before the end of July the fall migration had begun and each day brought new thrills, with the addition of Black-bellied Plover, Black Turnstone and Pacific Kittiwake, and many other northern birds to the growing collection. Tourists came in sometimes to view the bird skins. Among them were John Muir and his friend Henry Fairfield Osborn, who had learned of the boy's interest in birds. One summer resident, Joseph Mailliard, became later a valued friend.

Officers from the revenue cutters out in the bay sometimes came into the workshop. To one of these men Joe confided his feeling of indebtedness to the mission folk who had been so kind to him. The officer promptly suggested a lecture benefit, with the birds of Sitka as the subject. A hall was engaged, the venture advertised, and a little fund reaped for the Mission. Later this same officer expressed a desire to take back to a New England friend a collection of Alaskan bird skins and bought so generously, giving twenty-dollar gold pieces in payment, that Joe was saved the embarrassment of writing home for passage money.

Leaving Sitka in late August, Joe stopped in Seattle for several days as the guest of Trevor Kincaid, collecting in the outskirts of the town. In after years he sometimes spoke of the kindness of his young host, now Professor of Zoology at the University of Washington.

Back in Pasadena, he began his last year of college work at Throop. Almost all of his Saturdays and holidays were spent in the field, as his old notebooks testify. Up in the canyons above Pasadena, over in the Arroyo Seco, where a little stream flowed the year around, or down in the willow thickets of El Monte, he tramped with friends of his own age, or an older companion, as Professor Conant or Frank S. Daggett. Each

day's experiences were carefully written up at night. These original manuscript notes were always kept with the greatest of care. There are in his desk today eighteen of the notebooks, the earliest one begun on January 1, 1894. The pages of these notebooks were not numbered, but on April 13, 1908, the first day of his first field trip in the interests of the Museum of Vertebrate Zoology, Joseph Grinnell wrote on the first page of a new notebook the numeral "1." The series of page numbers begun on that day he always kept. There are today in the Conference Room at the Museum many bound volumes of these manuscript notes, the last page headed "3005."

An Academy of Sciences had been organized in Pasadena in January, 1886, at the home of the Honorable Delos Arnold, but sometimes it lapsed into a "state of quiescent dormancy," to quote Pasadena's historian, Dr. Hiram A. Reid. In the spring of 1897, however, it was active and the members did much to encourage Pasadena's young scientists, no one of whom was aided more generously than was Joseph Grinnell. An exploring trip of three weeks duration among the Channel Islands was financed by the Academy that spring and its first publication, issued in August, 1897, was a report on the birds of Santa Barbara, San Nicolas and San Clemente islands, by Joseph Grinnell. Its second publication, March, 1898, was "Birds of the Pacific Slope of Los Angeles County," by the same author.

Just at this time interest in the discovery of gold in Alaska was at white heat and many companies of men were organized to seek it. Among them was the "Long Beach and Alaska Mining and Trading Company," composed of twenty-two men. Joseph was so enthusiastic over the north country that his parents put in their share of the required capital.

The "Lacy Yacht" was purchased, christened the "Penelope" and fitted for a voyage to the Arctic. Sailing from San Pedro on April 8, 1898, the Penelope tied up for three weeks on the San Francisco water front, while outfitting for two years in the north.

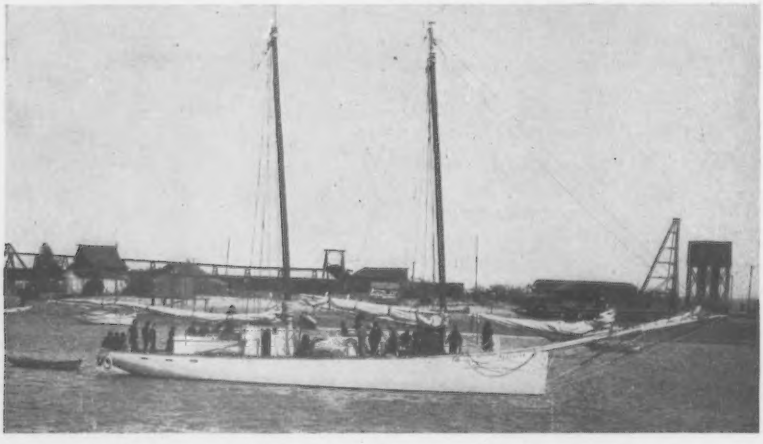


Fig. 1. The "Penelope" in San Pedro Harbor just prior to sailing for Alaska on April 8, 1898.

On the ninth of July the little schooner, powered by sails only, reached Cape Blossom. A river steamer was built from parts brought north and some of the group steamed up the Kowak River to seek winter quarters.

Joseph Grinnell has written (introduction to Pac. Coast Avif. No. 1) of the place selected: "Our camp was situated in a stretch of spruce woods on the south side of the Kowak opposite the mouth of the Hunt River, which heads in the Jade Mountains on the north side of the Kowak Valley. Several short trips were made during the fall and spring into the surrounding country, so that a fair knowledge of the local geography was acquired. On the 7th of June, 1899, we broke camp and steamed down the Kowak to the Delta where we camped until June 27, when the ice opened enough to allow us to cross Hotham Inlet to Cape Blossom. The "Penelope" had wintered in Eschscholtz Bay, and she arrived off Cape Blossom on the 3rd of July. We took final leave of Cape Blossom on the 8th, put in at Chamisso Island for a part of the 9th, and rounded Cape Espenberg through the scattering ice-pack on our way out of Kotzebue Sound on the 10th of July, 1899."

Among the group wintering on the Kowak was Dr. William V. Coffin, a friend of Joseph's parents and physician to the expedition. The two became fast friends. Together they took their turns at cooking for the crowd. Dr. Coffin has estimated that

Fig. 2. The "Cooks' Union," Grinnell (left) and Shafer, aboard the "Penelope" in Bering Sea, June 7, 1898. Photograph by Clyde Baldwin.

they walked a thousand miles that winter on their snowshoes, hunting and exploring. He recalls that when shortened days lessened the opportunities for outside activities Joseph memorized a thick glossary of scientific terms and passed a perfect examination when quizzed by the doctor for an hour on the contents of the book.

Word of the discovery of gold on the beach at Nome, where many gold-hunters had camped on their way north, caused a return to that region. From July 20, until October 2, 1899, claims on the beach, or on Buster Creek, ten miles up the Nome River, were worked so continuously that there was no time for ornithology. By the end of September the weather was too cold for sluicing and the claims were involved in litigation, so that most men of the company sailed for home. Joseph Grinnell, alone, of all the group, felt that he had gained by his venture.

Those eighteen months in the north were faithfully recorded in letters home, which his mother later arranged into a narrative, "Gold Hunting in Alaska," brought out by

the David C. Cook Publishing Company, in 1901. For many years the letter writer looked askance at the little book, partly because of the boyish nature of many of his own sentences. Later, however, he came to realize that the record had a definite historical value. The ornithology of the expedition was published as the "Birds of the Kotzebue Sound Region, Alaska," issued in November, 1900, by the Cooper Ornithological Club as "Pacific Coast Avifauna, No. 1."

Fig. 3. Joseph Grinnell in 1901. Photograph taken by Chester Barlow at Santa Clara, California, February 22.

Back in California, Joseph's cherished hope of sometime attending Stanford University was fulfilled. Here rich friendships awaited him: Chester Barlow was Editor of the Condor, Dick McGregor was a fellow bird-enthusiast, Walter K. Fisher and Wilfred H. Osgood had collected in the field for Dr. C. Hart Merriam, Chief of the Biological Survey, whose writings were Joseph's gospel, and to meet them was thrilling. Other congenial companions there were, too, among them Edmund Heller and Robert Snodgrass.

Long hours in the laboratory, evenings in the library, Saturdays in the field, or up in the old Academy of Sciences Building, each day was full, but always he loved best the days spent out of doors. While working in the Stanford Library, the young ornithologist conceived the plan of making a state list of the birds of California, as had been done for Colorado by Wells W. Cooke. Of this enterprise he wrote in the Condor (May, 1901, p. 3): "This I realize is assuming a very difficult and tedious task. . . . But even

if I cannot bring such a thing to publication myself, I shall keep the bibliography and citations systematically arranged, so that anyone else can take up the work where I leave off."

This self-made pledge was faithfully kept for thirty-eight years; most of the work was done outside of regular working hours, on Sundays or holidays. When he closed his desk for the last time late on Saturday afternoon of May 27, 1939, the manuscript of the third installment of the "Bibliography of California Ornithology" lay within, almost ready for the typist and work on a new state list was well started. In the three installments, as published, there are listed 6840 titles of papers, in part at least, on the ornithology of California, written by a total of 1144 authors. Also, throughout the years there was kept a synonymy for each species of bird occurring in California, giving each reference in literature known to the compiler.

During his years at Stanford, Joseph Grinnell was largely self-supporting, teaching zoology and botany in the Palo Alto High School. In the summer of 1900 he served as assistant in embryology at the Hopkins Seaside Laboratory of Stanford University. In the summers of 1901 and 1902 he was instructor in ornithology there.

The death of Chester Barlow in November, 1902, brought sorrow to a wide circle of friends. McGregor, then in the Philippines, shared deeply in the sense of loss, but it was for those still at Stanford to carry on. The September, 1902, editorial page of the Condor carried the heading "Chester Barlow, Editor and Business Manager. Walter K. Fisher and Howard Robertson, Associates." The November issue read: "Walter K. Fisher, Editor. Joseph Grinnell, Business Manager, Howard Robertson, Associate."

Fisher served as editor through 1905. Then the pressure of other work, in another field, forced him to give up all but associate editorship, which he held for one year longer. The loyal support which was promised to Joseph Grinnell by other Cooper Club members if he would undertake to edit the Condor was so faithfully supplied that he was enabled to carry on the editorial duties through the remaining thirty-three years of his life, assisted by a changing group of associate editors. When he proposed any innovation at one of the annual meetings of the governing board, there was always a hearty "go ahead, Joe, we'll back you up." There were some wry faces when simplified spelling was introduced, but the disease, as some regarded it, was allowed to run its course.

In the spring of 1903 the work at Stanford toward a doctorate in zoology was interrupted by a severe attack of typhoid fever. While recovering in Pasadena, the convalescent was offered the position of instructor in biology at Throop Polytechnic Institute. He accepted it with the thought of putting off his return to Stanford for one year. That opportunity never came, but in October of 1912, while doing field work at Dutch Flat, Placer County, he wrote his former major professor at Stanford, Charles H. Gilbert, telling him of his wish to complete the requirements for the degree. The reply received was so cordial and the way so smoothed that he was encouraged to offer a thesis. He submitted "An Account of the Mammals and Birds of the Lower Colorado Valley with Especial Reference to the Distributional Problems Presented." This was accepted by his committee, the written examination taken, and on May 19, 1913, he received his doctorate from the hand of David Starr Jordan.

The teaching at Throop permitted many week-end trips into the field about Pasadena. Longer excursions were made into the desert during Christmas holidays. Often he was accompanied by students from his classes, boys in their middle teens. Three of these, Charles L. Camp, Joseph S. Dixon, and Walter P. Taylor, continued in the field of science.

Part of the summer vacation of 1904 was spent in the Mount Pinos country, with Joseph Dixon as assistant. The three following summers were devoted to a study of the birds and mammals of the San Bernardino Mountains, the first one with Joseph Dixon again as assistant. The second and third summers the author of this account served as assistant, following a wedding at Glendora, California, on June 22, 1906. Those

Fig. 4. In spring of 1904.

Fig. 5. In May of 1910.

Portraits of Joseph Grinnell

summer days were busy ones, each filled to the brim with activity. There were trap lines to be visited before the rays of the sun struck, or ants began their day. After breakfast there was a two-hour tramp, with notes to be taken, butterflies to be collected for a brother, grasshoppers for a friend in Philadelphia, plants for Miss Eastwood, who had already energetically bespoken the aid of all her friends in helping to build up a collection at the California Academy of Sciences to replace the one lost in the San Francisco fire of April, 1906. After lunch came the putting up of the morning's mammal catch and of the five birds usually selected on the early walk. Any rattlesnakes found were noosed, chloroformed, and put in formalin. From four until four-thirty in the afternoon came relaxation, in other words, fishing. A neighbor, "Old Man Martin," lived three miles upstream. Downstream the nearest neighbors were the Glass family, who kept the Seven Oaks resort, seven miles away, so the stream yielded plenty of lively trout. After an early supper there were traps to be re-set and baited, bats to be tried for in the twilight, lastly moths to be caught as they came toward the flicker of the little campfire. In July, 1906, an acquaintance, Harvey Monroe Hall, a botanist of the University of California, came to camp nearby with his young nephew. Mutual interests led to lifetime friendship and to the publication in 1919 of "Life-zone Indicators in California," in joint authorship.

That third summer in the San Bernardinos there was less tramping, for much time was spent in turning into manuscript the combined field notes of the three summers.

This was drudgery, for writing did not come easily to Joseph Grinnell. His desire to make every sentence which he wrote exact and clear led him, all his life, to write and re-write manuscripts, often putting them aside to ripen for awhile before the last revision. One of his student's has said of him: "He scorned language that was not exact, scientifically accurate and colorless." But in truth, he loved color if it were the right color, admiring greatly the writings of Elliott Coues. Bradford Torrey's "Field Days in California" always gave him pleasure. Many popular writers, though, annoyed him by their carelessness. Poetry was a language which he declared he could not understand.

That fall the manuscript for the "Biota of the San Bernardino Mountains" was no sooner sent off to the University of California, as an offering for their series of publications in Zoology, than serious work was begun on "Mammals of the Pacific Slope of Los Angeles County." Pressure of teaching and editorial work on the Condor caused the work to be set aside. Often in later years, when in a self-deprecatory mood, Joseph Grinnell would say: "That paper ought to have been completed, if I had worked just a little harder I could have put it through." Two other favorite projects were never carried out, though definitely planned for, one a monograph of the Song Sparrows of California, the other of the pocket gophers. These two plastic groups especially interested the student of geography and evolution.

In the spring of 1907, Miss Annie M. Alexander called at our Pasadena home in search of Joseph Dixon, recommended to her by Frank Stephens as an assistant to accompany the summer expedition which she was planning to take north for field work in Alaska. The vivid memory of his own Alaskan days later impelled Joseph Grinnell one day to send north to Alaska a letter enumerating many things which might be done to make the expedition most useful to science. The letter showed such a deep interest in the materials being collected that near Thanksgiving time Miss Alexander wrote inviting him to spend the holiday at her Oakland home in order to view the results of the summer's work. There she unfolded her plan for a museum of vertebrate zoology at the University of California.

During the Christmas holidays which followed she defrayed the expenses of the director-to-be on a tour of eastern museums, where he benefitted greatly by talking with scientists with whom he had long corresponded, and by studying methods of caring for specimens and systems of cataloguing. Later there were other eastern trips, ten in all, during the years to come. The contacts made with men and institutions were stimulating and much appreciated, but always Joseph Grinnell came back to California as deeply concerned as ever with the problems of his beloved State and more than ever aware of his good fortune in serving so wise and generous a patron. As an evidence of his own faith in the Museum's future he donated to it in 1909 his mammal collection, later his bird collection. His books, bound files of the Auk, Condor, and other magazines, as well as files of separates will also always remain in the Museum, freely accessible to future students, as they were to those of his day.

It was in August, 1908, that the family home was established in Berkeley. Here three sons—Willard Fordyce, Stuart Wood, Richard Austin—and one daughter, Mary Elizabeth, grew up.

At first all of the Director's time was absorbed by museum duties and by field trips in search of pertinent material to be added to the growing collections. In the University's summer session of 1909, however, a series of lectures on birds was given. Later four o'clock afternoon lectures were given, open to the public. In 1913 regular undergraduate courses in vertebrate zoology were instituted and continued through the years. These courses attracted the attention of serious students to the opportunities for graduate research in the Museum of Vertebrate Zoology. Each year some graduated students

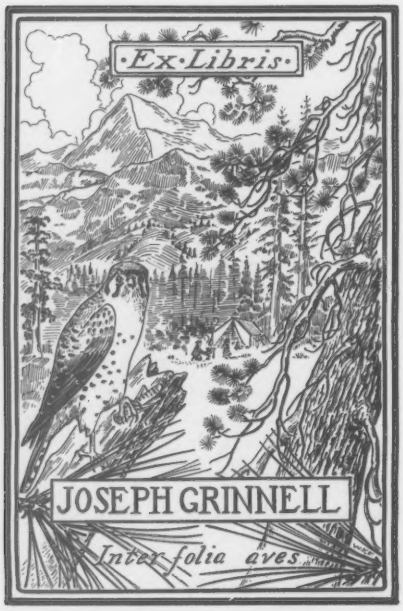


Fig. 6. Book plate designed by Walter K. Fisher in 1907 and first printed by Charles A. Nace.

returned to work within the Museum's precincts for higher degrees. Other students came from time to time from other institutions.

It was the Museum's plan to build up a collection primarily of Californian species, but with comparative materials from areas outside of the state. Accordingly, there have been many excursions into fields outside of California. Materials from several of these trips were published upon by Joseph Grinnell, but in only one of these extralimital expeditions did he take part—a field trip into Lower California in the fall of 1925. Within California it was the plan to sample, broadly at first, then more in detail, representative areas scattered throughout the state. The first field excursion undertaken after the founding of the Museum was to the Colorado Desert in the vicinity of Salton Sea, in April of 1908. In this enterprise Joseph Grinnell took active part. The following summer he also took part in the work carried on in the San Jacinto Mountains to ascertain the relationship of their fauna to that of the adjoining Colorado Desert and to that of the San Bernardino Mountains, already worked, and lying beyond the barrier formed by San Gorgonio Pass.

In the spring of 1910, along the Colorado River between Needles and Yuma, three months were devoted to a study of the river's effect as a barrier in the distribution of desert-dwelling mammals occupying similar habitats on opposite sides of the river, beyond the riparian vegetation which bordered it. Twenty camping sites were occupied on the California side of the river, which itself served as the party's highway, and nine on the Arizona side. A gratifying amount of geographical variation was detected in the materials secured.

As mentioned earlier in the present article, a study of this material was published (in 1914) as "An Account of the Birds and Mammals of the Lower Colorado Valley." In reviewing this paper, Dr. F. B. Sumner (Science, January 8, 1915, pp. 64-69) commends the close attention given to geographic races, and says, "The evolutionary theories of Darwin and Wallace were largely founded upon personal observations of geographical distribution. The modern student of genetics, on the contrary, carries on his studies for

Fig. 7. Grinnell tending the stew, 1½ miles NE Barstow, California, March 15, 1914. Photograph by Charles L. Camp.

the most part in the laboratory and the breeding pen. It is significant, therefore, that Bateson [1913, "Problems of Genetics"], perhaps the foremost living Mendelian, devotes a considerable portion of a recent volume to the problems of geographic variation. And one can hardly read that volume attentively without being convinced that the field naturalist holds the key to some of the most important secrets of nature. It is not improbable, therefore, that works of the sort here reviewed will come to receive more serious consideration from those who are concerned primarily with the problems of organic evolution."

In the summer of 1911 Joseph Grinnell was one of a group from the Museum which spent three months studying the fauna of the Mount Whitney region. In the autumn of 1914 the first regular field work of a survey of a cross-section of the Sierra Nevada, including Yosemite Valley, was begun. The work here was carried on intermittently until August of 1920, and was participated in by eight persons. He took an active part in the field work and was senior author of the report published upon the findings (Animal Life in the Yosemite, University of California Press, 1924).

In the spring of 1924 work was formally begun in the Lassen region of California, on a plan similar to that used for the Yosemite survey. The policy which resulted in the

Fig. 8. On the way to the trap line. Sierra Nevada, summer of 1915.

selection of the Lassen area for study is well illustrated in the introduction to the published report, of tripartite authorship, which reads: "In the Lassen section there are under way profound modifications of earlier conditions, modifications due directly to the increasing activities of man—grazing and over-grazing by domestic stock, lumbering, road-building, draining of lakes and other activities associated with irrigation projects, and the opening up of a new National Park to public use. Facts as to the status of species in the region at a given stage in the general faunal changes engendered by these processes will become significant in their bearing with regard to the conditions reached in the future."

In addition to the facts set forth in the published reports upon the Museum's various field studies, there were gathered other data which served in the preparation of theses by graduate students and as source material for such publications as the "The Game Birds of California" and the "Fur-bearing Mammals of California."

The field trips listed above were those of longest duration, or of longest consideration of an area, but there were many, many others—a day, a week, ten days, spent in visiting some new field, or visiting at some new season of the year an already sampled region. Dozens of little vacation trips come to mind—memories of Cow Head Lake in Modoc County, Scott River Valley in the Siskiyous, South Fork Mountain in the Trinity-Humboldt country, Panoche Pass, Death Valley, the Waucoba Range. The last

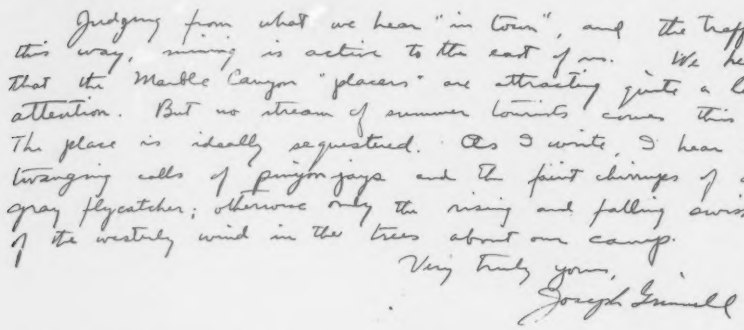
Fig. 9. Joseph Grinnell preparing specimens in the field.

real field trip taken by Joseph Grinnell was when, on May 23, 1938, he joined a field party from the Museum of Vertebrate Zoology which was at work in the Providence Mountains of San Bernardino County. Here, on May 29, 1938, he put up his last specimen, a Black-chinned Sparrow secured by David Johnson.

One Californian area was in his later years especially attractive to Joseph Grinnell because of his hope that within its confines Nature would be allowed, to a degree not usually possible, to work out her problems untrammeled by man's interference. This area became the Point Lobos State Reserve. Here in mid-November of 1934 a year's work was undertaken by the Museum of Vertebrate Zoology with the objective of recording for the use of the student of the present and the analyst of the future "information which would show the kinds of land vertebrates present within the Reserve; and for each kind the frequency of occurrence and the relative abundance; the habitat; the more appreciable relationships with the physical environment; the nature of its biotic relationships; and the annual cycle of its activity in the Reserve" (Vertebrate Animals of Point Lobos Reserve, 1934-35, p. 2).

One of the concluding paragraphs of the report (p. 152) sets forth the tenet that: "Administrators of parks need, we think, to convince themselves and then to help visitors in the parks learn that natural processes are capable of maintaining an area with all the desirable qualities just to the extent they are allowed to do so by not interfering with them. Artificial help is not required; indeed, it is not beneficial, but it is positively a hindrance to the natural and hence desirable expression of a truly primeval area. We can not make such an area, but we may so treat land by bona fide protection that its primeval qualities come to predominate. Again, we need to make no special plans for the benefit of the animals, the plants, or the rocks. What we need to do is to conduct ourselves in such a manner that these objects may exist according to normal process on a long-time schedule."

As always, in last analysis, the project was made possible through the continued interest of Miss Alexander. In a lesser, but important degree, there was behind the project the support of the Carnegie Institution of Washington and the Save-the-Redwoods League of California. In this piece of research Jean M. Linsdale of the Museum staff was co-worker in the field and co-author of the published report.



Judging from what we hear "in town", and the traffic this way, mining is active to the east of us. We hear that the Marble Canyon "placers" are attracting quite a lot of attention. But no stream of summer tourists comes this way! The place is ideally sequestered. As I write, I hear the twanging calls of piñon jays and the faint chirrups of a gray flycatcher; otherwise only the rising and falling swish of the westerly wind in the trees about our camp.

Very truly yours,

Joseph Grinnell

Fig. 10. Ending of a letter written from Waucoba Pass, 7500 ft., Inyo Mts., June 12, 1937.

The faunal investigation at Point Lobos happened to attract the interest of Mr. and Mrs. Russell P. Hastings of San Francisco, who, as a result of this interest offered their ranch to the University of California for long-time study on similar lines. The ranch, like Point Lobos, lies in Monterey County, but at the head of Carmel Valley. Visits to the ranch between December 21, 1936, and April 8, 1939, usually including long conferences with Mr. and Mrs. Hastings, gave Joseph Grinnell increasing pleasure. On an area administered as is the Hastings Natural History Reservation there is opportunity for continued observation of a single species or individual. He wrote in his annual report to President Sproul of the University of California, July 10, 1936 (but in another connection): "Thoroughly to learn the lives of individuals of any one given wild species of animal provides facts essential to the intelligent handling of conservation problems involving that species, and also, when the results are made known, stimulates that personal interest and appreciation among people at large that is effective in guiding rational human attitudes toward it."

Keenly aware that, as the author of Lorna Doone wrote in 1869, "We desolate more than we replenish the earth," Joseph Grinnell during the last twenty years of his life turned his energies more and more toward emphasizing the tremendous need for better

conservation of our natural resources if this land is not to become as are the deserts of Arabia. With the quiet zeal of his Quaker ancestors he labored. "A Conservationist's Creed," "The Burrowing Rodents of California as Agents in Soil Formation," "Bird Life as a Community Asset," and "Wild Animal Life as a Product and as a Necessity of National Forests" are among those of his writings which deal with conservation problems.

Fig. 11. Camp in the Providence Mountains on June 1, 1938. From left to right, Aldrich, Arvey, Johnson, Rodgers and Grinnell.

Lectures Joseph Grinnell gave before his classes and indoor laboratory exercises he supervised, but it was in the laboratory of the Berkeley Hills that he was happiest, encouraging students to go directly to Nature for their inspiration. The writing last named of those mentioned above was read on April 10, 1924, before the California Section of American Foresters, meeting in Hilgard Hall, University of California. That message expresses so well the philosophy of Joseph Grinnell the Naturalist that part of it may well be repeated here: "The service of National Forests to the vacationist involves his thorough-going physical, mental, and esthetic recreation. In performing this service the animal life existing within the National Forests should constitute, I believe, at least next after the trees themselves, the most valuable single asset. For the best recreative forces in nature are those which serve most quickly to call into play latent and seldom used faculties of mind and body—those faculties whose exercise tends

to restore the normal balance to the human mechanism that special or artificial conditions of living have upset. Foremost among these recreative elements in the forest are the living things that move in sprightly fashion and utter sounds, exhibit color, and change in form, and by these qualities attract and fix the person's interest. To enthusiastically seek acquaintance with these primal objects of interest is, of course, to know the thrill of vigorous muscular activity; but better yet, to bring into use the generally neglected senses of far-seeing and far-hearing, to invite an esthetic appeal of the highest type, and an intellectual stimulus of infinite resource. . . ."

SOCIETIES AND COMMITTEES WITH WHICH JOSEPH GRINNELL WAS AFFILIATED

Cooper Ornithological Club, Member from 1894; Life Member from 1919; President, Northern Division, 1901, 1902; Business Manager, 1902-1905; Associate Editor of the Condor, 1903-1905; Editor, 1906-1939; President, Board of Governors, 1938-1939.
American Ornithologists' Union, Associate Member from 1894; Fellow from 1901; Member of Council, 1914-1939; Member Committee on Nomenclature, 1914-1919, 1925-1931; Vice-president, 1923-1929; President, 1929-1932.
California Academy of Sciences, Member from 1901; Fellow from 1919; Member of Council and Librarian, 1911-1919; Member of Council and Second Vice-president, 1934-1937.
American Association for the Advancement of Science, Member from 1904; Fellow from 1914.
American Association of Museums, Member from 1909.
Sigma Xi, California Chapter, Member from 1909; Vice-president, 1929-1930; President, 1930-1931.
Wilson Ornithological Club, Member from 1913.
Biological Society of Washington, Member from 1914.
American Society of Ichthyologists and Herpetologists, Member from 1916.
Ecological Society of America, Member from 1916; Vice-president, 1932; Member Editorial Board, 1926-1931.
Western Society of Naturalists, Member from 1916; Secretary, 1918-1919.
Zoological Society of London, Corresponding Member from 1917.
American Society of Mammalogists, Member from 1919; Member Board of Directors, 1919-1939; Vice-president, 1935-1937; President, 1937-1938.
British Ornithologists' Union, Foreign Member from 1919.
Boone and Crockett Club, Associate Member from 1919.
Editorial Committee, University of California, Member, 1920-1931, 1932-1937; Acting Secretary, summer of 1926; Acting Chairman, summer of 1928; Acting Manager of University of California Press, summer of 1926; Co-editor of University of California Publications in Zoology, 1921-1936.
American Society of Naturalists, Member from 1921.
American Association of University Professors, Member from 1924.
Academy of Natural Sciences of Philadelphia, Correspondent from 1926.
American Academy of Arts and Sciences, Fellow from 1930.
Washington Academy of Sciences, Member from 1931.
Nebraska Ornithologists' Union, Honorary Member from 1932.
International Wild Life Protection, American Committee, Advisory Committee, member, 1930-1939.
American Wildlife Institute, Trustee, 1936-1939.
Wildlife Society, Member Advisory Committee, 1937-1939.
National Association of Audubon Societies, Member from 1938.
The Linnaean Society of New York, Honorary Member from 1938.
Sierra Club.
Pacific Northwest Bird and Mammal Society, Member from 1927.
Pan-Pacific Union, Member from 1936.
Ottawa Field-Naturalists' Club.

ANIMALS NAMED AFTER JOSEPH GRINNELL

Insects:

Cordillacris grinnelli Rehn and Hebard (1908).
Halictus grinnelli Cockerell (1916).

Birds:

Regulus calendula grinnelli W. Palmer (1897).
Geranoaëtus grinnelli L. H. Miller (1911).

Glaucidium gnoma grinnelli Ridgway (1914).
Agelaius phoeniceus grinnelli A. B. Howell (1917).
Lanius ludovicianus grinnelli Oberholser (1919).
Penthestes gambeli grinnelli van Rossem (1928).
Loxia curvirostra grinnelli Griscom (1937).
Carpodacus mexicanus grinnelli Moore (1939).
Polyborus prelutosus grinnelli Howard (1940).

Mammals:

Scapanus latimanus grinnelli Jackson (1914).
Procyon lotor grinnelli Nelson and Goldman (1930).
Eutamias dorsalis grinnelli Burt (1931).
Microtus californicus grinnelli Huey (1931).

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11. Description of a New Towhee from California. < Auk, XIV, July, 1897, pp. 294-296.
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18. Our Feathered Friends | By | Elizabeth Grinnell and | Joseph Grinnell | [vignette] | Boston, U.S.A., | D. C. Heath & Co., Publishers | 1898. Pp. xii + 144, 37 illustrations in text; small 8vo, boards.
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175. Queries. < Condor, XI, July, 1909, p. 139.
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240. The Outlook for Conserving the Band-tailed Pigeon as a Game Bird of California. < Condor, XV, January, 1913, pp. 25-40, 1 map.
241. [Review of Forbush's] A History of the Game Birds [etc.] < Condor, XV, January, 1913, p. 47.
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288. [Review of W. W. Cooke's] Our Shorebirds and Their Future. < Condor, XVII, November, 1915, p. 237.

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Berkeley, California, November 15, 1939.

WHEN JOSEPH GRINNELL AND I WERE YOUNG

WITH ONE ILLUSTRATION

By WALTER K. FISHER

On a day early in 1900 a red-cheeked, serious young man walked into the zoological laboratory of Stanford University. It was not much of a laboratory judged by the standard of modern gadgets, being one large room divided roughly into three parts by two tiers of bird and mammal cases—these surmounted by numerous skeletons of fishes and other vertebrates. Adjacent was a lecture room and a small museum housing the collection of fishes, reptiles, and batrachians. Off an entry way a small office served as the sanctum of Dr. C. H. Gilbert, head of the department. Professors G. C. Price and Harold Heath, and Instructors J. O. Snyder and E. C. Starks comprised the faculty. All teaching and investigation was done in these cramped quarters and we students in more senses than one rubbed elbows with our instructors. Nor must I omit among the latter, President David Starr Jordan who wandered in whenever irked by the worries of his office, his approach heralded by a heavy tread and the clink of keys and silver, which he habitually jingled in a trouser pocket. His was a manifest "presence," every whit as distinguished as that of his revered teacher, Louis Agassiz. He had a marvelous capacity for shutting out the world and plunging instantly into a contemplation of his beloved fishes. One felt that for the time he had forgotten, or had little use for, Jordan the president. Withal he was warm-hearted, drily humorous, sympathetic. Usually he had a word for each of the "advanced" students; and to those of us who were not working on fishes he would sometimes jokingly deplore our waste of good opportunity. He rather subtly attempted the conversion of Grinnell to ichthyology! Wherever he went he shed light, a light dimmed at this time by stark tragedy—the loss of his beloved little Barbara, friend of the birds.

Jordan's influence on Grinnell was lasting. I know that Grinnell's admiration for Jordan was deep and sincere. I cannot refrain from quoting at this time Darwin's tribute (Life and Letters of Charles Darwin, vol. 1, p. 186) to Professor J. S. Henslow, the wise mentor with whom he took long walks, until he became known as "the man who walks with Henslow." To those of us who "walked with Jordan," the following rings true as a portrait of that rare man.

"Nothing could be more simple, cordial, and unpretending than the encouragement which he afforded to all young naturalists. I soon became intimate with him, for he had a remarkable power of making the young feel completely at ease with him; though we were all awestruck with the amount of his knowledge. Before I saw him, I heard one young man sum up his attainments by simply saying that he knew everything. When I reflect how immediately we felt at perfect ease with a man older, and in every way so immensely our superior, I think it was as much owing to the transparent sincerity of his character as to his kindness of heart; and, perhaps, even still more, to a highly remarkable absence in him of all self-consciousness. One perceived at once that he never thought of his own varied knowledge or clear intellect, but solely on the subject in hand. Another charm, which must have struck every one, was that his manner to old and distinguished persons and to the youngest student was exactly the same; and to all he showed the same winning courtesy. In short, no man could be better informed to win the entire confidence of the young, and to encourage them in their pursuits. It always struck me that his mind could not be even touched by any paltry feeling of vanity, envy, or jealousy. With all this equability of temper and remarkable benevolence, there was no insipidity of character. A man must have been blind not to have perceived that

beneath this placid exterior there was a vigorous and determined will. When principle came into play, no power on earth could have turned him one hair's breadth."

Darwin adds, "I owe more than I can express to this excellent man."

Dr. Jordan, with his flair for promising students, immediately took to Grinnell as did Dr. Charles Henry Gilbert, under whom years later Grinnell took his Ph.D. degree. Professor Gilbert was a scientist of very unusual talents, with a controlled and keenly logical mind. He exercised no patience with loose thinking or any work short of the best which a student could produce. His seminars afforded adequate outlet for his uncanny powers of searching analysis and relevant criticism. His students more than once have heard him relentlessly demolish a thesis of one of the Elect. Biology would have been the gainer if his comments had been published verbatim. Oracularness was to him as the proverbial red rag. This went on for years; our own incapacity, if we failed to know good thinking and bad.

These two men complemented each other and young Grinnell was fortunate. They gave the impetus and training that he most needed. Others had a hand—Professor G. C. Price, a great teacher, with whom he studied embryology; William Russell Dudley, the kind botanist; the enthusiastic Harold Heath, just entering on his career in invertebrate zoology—a master anatomist; Vernon Kellogg, talented young entomologist with a department of his own and a flair for the newest in biology.

Maybe his student associates helped in informal ways not open to the faculty: Edmund Heller, Robert E. Snodgrass, J. F. Abbott, William F. Allen, M. H. Spaulding, George Coleman, Malcolm Anderson, Sam Burcham. Alvin Seale, R. C. McGregor, Dane Coolidge, and W. W. Price, former students, were "in and out," but not resident at that time. Snyder and Starks, although technically instructors, belonged in our "age class" (or so we thought) and were treated without reverence.

Grinnell and I roomed in the same house in Palo Alto, which was then a small spread-eagle town with board sidewalks, unpaved streets very muddy in winter, dim street lights, and stores with false-fronts. Autos were, of course, unknown; "carriages met all trains." Everyone, with the price, rode a bicycle. A sumptuous steak cost two-bits. William McKinley was president of the United States; Victoria Regina occupied the throne of England; and in American ornithology the Age of Coues had just closed. The Cooper Ornithological Club was seven years old and its "Bulletin," entering the second volume, had been named "The Condor."

Grinnell had recently returned from a year in the Kotzebue Sound region of Alaska. His collection of birds, stored in cardboard boxes of various sizes and ranged against the walls and under the bed, was in constant demand. He became very deft in extracting the particular box he needed from the center of a tier, for he was at work on his "Birds of Kotzebue Sound," which was published by the Cooper Club in November, 1900, as Avifauna No. 1.

We all became intensely bird-conscious. When Grinnell arrived at Stanford there were only five local members of the Cooper Club, but by the end of that year there were sixteen, and Palo Alto became a center for meetings, although we met also at Chester Barlow's in Santa Clara, at W. Otto Emerson's, Haywards, and occasionally elsewhere. In January, 1901, Grinnell became president of the club and there is no question that his enthusiasm and talent for leadership did much to promote its rapid growth.

At this time Chester Barlow was secretary of the club, its editor, and psychological center. He had a positive genius for friendship and we were all greatly devoted to him. His untimely death in 1902 brought to a sudden close the pioneer period of the club.

Grinnell and I were frequent visitors at Barlow's home in Santa Clara, which meant also an hour at C. A. Nace's printing establishment, for The Condor, still in pin-feathers,

Fig. 12. Members of the Cooper Club at Santa Clara, California, January 13, 1901. Left to right, Chester Barlow, W. Otto Emerson, Malcolm Anderson, Walter K. Fisher, A. J. Zschokke, C. S. Thompson, Harold Gay, W. L. Atkinson, E. H. Skinner, Joseph Grinnell, and R. C. McGregor.

needed coddling, and this involved a mort of talk, all in happy and hopeful vein. Barlow was a great optimist and Nace a patient humorist. Often the conversation turned to eastern ornithologists whom Barlow and Grinnell had never seen but whom I had fortunately known since early childhood—Robert Ridgway, Leonhard Stejneger, C. Hart Merriam, Joel Asaph Allen, Frank M. Chapman, Edgar A. Mearns, Edward W. Nelson, William Dutcher, H. W. Henshaw, John H. Sage, Witmer Stone, Charles W. Richmond, Frederick A. Lucas, and especially Charles E. Bendire, the patron saint of oologists. I had *seen* Elliott Coues—and even had *heard* him speak at an A. O. U. meeting; I certainly represented glamor to these avid young men.

On the occasion of one of our visits to Barlow's, Mr. Lyman Belding, the veteran ornithologist, came from his home in Stockton and regaled us with accounts of early days in California, and of his hunting and fishing trips in the Sierras. He was a shy, sensitive, lovable man, patterned for a poet, but fated for rough usage by life.

We also made occasional visits to the old California Academy of Sciences, on Market Street, San Francisco, where Mr. Leverett M. Loomis made us welcome. The Academy had an active section of ornithology, the guiding geniuses of which were the Mailliard brothers, Joseph and John, who proved most delightful hosts at little annual dinners, never to be forgotten by the fortunate guests. We became, severally, frequent guests of Joseph Mailliard. The Mailliard collection, kept in the basement of John's home, was always generously open for inspection and use. So began one of the friendships founded upon community of interest and mutual esteem. It may appropriately be recorded here that the Mailliard brothers were always generous in their support of the club—morally and substantially!

So time slipped by. Grinnell soon secured a position as teacher of zoology in the Palo Alto high school. In the summer we were both exploring, Grinnell on his own, I as a field naturalist for the Biological Survey under Dr. C. Hart Merriam. Inevitably I became saturated with Dr. Merriam's life-zone philosophy, which I lost no time in "spilling" to Grinnell. Geographic distribution now had a rationale.

There was bad news awaiting me when I returned in August, 1902, after an absence of six months. Dr. Gilbert, J. O. Snyder, and I had been deep-sea dredging with the old U. S. Fisheries steamer "Albatross" among the Hawaiian Islands, and had spent a marvelous week among the sea birds of Laysan. Barlow was ill—a hopeless case of tuberculosis aggravated by confining overwork at his bank. He died November 6. We were young, impressionable. I have often wondered what life would have been like if Barlow had lived his normal span. I think Grinnell felt the same way.

Grinnell and I took over The Condor, and in the spring of 1903 the A. O. U. held its first California meeting; but not until we both had had a bout of typhoid during the now famous Palo Alto epidemic. In the autumn he took up his duties of instructor at the Throop Polytechnic Institute, Pasadena, and our close association of three and a half years was continued by frequent letters until 1906. In respect to The Condor, I felt that he was the logical successor to Barlow, and with the January issue of 1906, he became Editor, with what happy results has long been a matter of history.

If in these reminiscences more space has been accorded other persons than Grinnell, the purpose has been to sketch his environment during an important formative period of his life. He came to Stanford with graduate standing. He left a few years later, the youngest Fellow in the American Ornithologists' Union—a testimonial of interest and respect by the leading ornithologists of the country. This recognition was an important factor in his further development. It came at what is called the psychological moment. From that time there was never a doubt as to his ultimate position in his chosen fields of work.

Hopkins Marine Station, Pacific Grove, California, December 14, 1939.

LONGEVITY IN RAPTORIAL BIRDS AS INDICATED BY BANDING RECORDS

By E. LOWELL SUMNER, JR.

In the period from December 15, 1924, to June 1, 1929, the writer banded 143 raptorial birds of eight species in a region centering about Pomona, southern California. All but ten of these were juveniles. Eighteen additional individuals, of which all but three were juveniles, were banded between April 5, 1931, and February 8, 1933, in Merced and San Mateo counties. It appears now that sufficient time has elapsed to warrant the following tabulation of the returns, together with certain supplementary remarks covering each species.

SUMMARY OF RETURNS

Species	Total number banded	Number of returns	Percentage of returns	Maximum age	Average age	Average distance (miles) from place of banding
Cooper Hawk	5	0	0	.....	.....	....
Western Red-tail	25	4	16	1 yr., 5 mos.	7¾ mos.	69
Golden Eagle	5	1	20	3 yrs., 10 mos. +	3 yrs., 10 mos. +	23
Sparrow Hawk	12	1	8	2 yrs., 7 mos.	2 yrs., 7 mos.	10
Barn Owl	55	11	20	10 yrs., 4 mos.	3 yrs., 2 mos.	21
Pasadena Screech Owl	38	5	13	13 yrs.	5 yrs.	1
Pacific Horned Owl	15	2	13	2 yrs., 7 mos.	2 yrs., 6 mos.	6
Long-eared Owl	5	1	20	9 mos.	9 mos.	49
Total	161	25	Av. 12		Av. age 3 yrs., 4 mos.	•

Cooper Hawk. *Accipiter cooperii.* Although the number banded was small, it is not unlikely that the lack of returns is correlated with the fact that this species is much less often brought down by hunters than are less wary species such as the Western Red-tail or Barn Owl.

Western Red-tail. *Buteo borealis calurus.* As a result of their tendency to occupy prominent perches along highways, young red-tails fall prey to target shooters in greater numbers than almost any other hawk. All four returns were banded as juveniles. One was "shot," one "found" (shot?), one "captured" (trapped?) and one caught in a coyote trap.

As nearly as can be ascertained from the available data, one bird wandered eastward from the nest site ten or more miles, while the other three traveled due north 10, 20 and 235 miles, respectively.

Golden Eagle. *Aquila chrysaëtos canadensis.* The single return was from an individual captured at the age of 3 years and 10 months, 23 miles southwest of the point where it had been banded as a juvenile. After being held in captivity for about a month the bird was released where caught, so that its life span may be regarded as in excess of the figure indicated.

Sparrow Hawk. *Falco sparverius.* Banded as a juvenile, the single bird furnishing a return was "found dead" (?), at the age of 2 years and 7 months, ten miles northeast of its birthplace.

Barn Owl. *Tyto alba pratincola.* Of the owls, this species seems to be the most vulnerable to depredations by man, unless we accept the mortality figure for the Long-eared Owl. It seems likely that the figure of 20 per cent for the latter is misleadingly high by reason of the small number of individuals involved, so that it may not be as trustworthy as the same figure for the Barn Owl. The habit of roosting in barns, churches and eucalyptus groves so commonly displayed by Barn Owls in southern California renders them particularly vulnerable to small boys with .22 rifles, as well as to others who are supposed to know better. All of the banded birds were juveniles.

The eleven returns are roughly divisible into two age classes. The younger group includes four birds shot, one "recovered" (shot?), one "found" (shot?) and one "captured." The greatest age in this group was 1 year and 2 months, while others ranged from three to ten months. The older group comprises three birds "found dead"; these were aged 4 years and 5 months, 6 years and 1 month and 10 years and 4 months, respectively. Of a fourth bird in this group, the band only, with no sign of the carcass, was picked up ten years after banding.

From the nature of the available data it is presumed that the birds of the long-lived group were not shot but met "natural" deaths. The records fail to indicate any correlation between longevity

and possible remoteness of individual territory from human depredations. Neither is there any discernible correlation between longevity and distance between birthplace and the territory of adulthood.

Five birds traveled less than four miles from their birthplaces. The others traveled 7½ miles northwest, 12 miles west, 19 miles southwest, 29 miles west, 62 miles south, and 85 miles northwest, respectively. The lack of records of eastward travel may be due to chance and to the small numbers involved, since there is ample territory, combined with an abundance of owl shooters, to the east.

Pasadena Screech Owl. *Otus asio quercinus*. Without doubt the seclusive habits of Screech Owls have protected them from their human enemies. Apparently when once their territories have been established with a hollow tree as a basis, a placid existence extending over many years is to be expected, at least in areas close to human habitation where Horned Owls, racoons and similar natural enemies have been rendered scarce.

Of the five returns, none is definitely known to have lived less than three years. One adult female was banded while incubating, and her age could not be ascertained, although it was obvious that she must have been at least one year old at the time. Approximately a year later she was robbed of her eggs by small boys and although not killed by them, abandoned the nest site. In the longevity calculations the life span of this bird has been recorded as 2 years and 1 month because that was the only period covered by definite observations.

Regarding two other Screech Owls whose ages were accurately known, it is interesting to note that they were nestmates and that, after living almost exactly three years, they died within three days of one another. One was "found dead in a tank" three miles west of its birthplace, while the other apparently collided with an electric wire in the town of its birth.

A fourth bird also was banded as an adult of unknown age, and was still very much alive four years later. Every year she raised a brood of young in the same hollow sycamore, and annually the young were subjected to various growth studies. Termination of her record resulted when the writer, not the bird, moved away.

The Methuselah of the tribe was an offspring of the above-mentioned female. Banded as a juvenile on May 28, 1926 this bird, evidently not long dead, was brought to Mrs. Myrtle S. Edwards of Claremont, California, May 5, 1939. It was about one mile from its birthplace, and had attained the venerable old age of approximately 13 years.

Pacific Horned Owl. *Bubo virginianus pacificus*. Because of their secretiveness and the relative remoteness of their haunts, it is to be expected that the returns from banding activities would be fewer for Horned Owls than for some other raptorial species.

One bird banded as a juvenile was captured in a pole trap 2 years and 7 months later at a state game farm about four miles northeast of its place of birth. The other return was from an adult at least one year old which originally was captured by the writer in an experimental pole trap and was shot 18 months later within eight miles of the site of its first capture.

Long-eared Owl. *Asio wilsonianus*. This is a secretive species, not commonly encountered by hunters in southern California. One bird banded as a juvenile was shot at the age of 9 months. At the time of its death it was 49 miles north of its birthplace.

CONCLUSIONS

Although the number of returns is too small to warrant statistical analysis, a study of the age classes tempts one to infer that, as in the case of the California Quail and other bird species, individuals which manage to survive the initial wave of postjuvenal mortality tend to live relatively safe and uneventful lives. We can explain this in part upon the basis of the greater experience shown by the adult birds in coping with danger. In addition, it is probable that a bird which has acquired its life territory is less frequently beset with hazards requiring split-second reactions than is the younger individual which has not yet become thoroughly familiar through long association with the best roosting places, the most protective cover and the most favorable feeding grounds.

The records here cited also indicate that in general owls may live longer than hawks. If we include diurnal, predatory Man with the other enemies of raptorial birds, this inference no doubt is correct, but if only their *native* enemies are considered, this difference in longevity may be more apparent than real.

National Park Service, San Francisco, California, November 29, 1939.

A NEW RACE OF CARACARA FROM THE PLEISTOCENE OF MEXICO

By HILDEGARDE HOWARD

Excavations carried on during 1938 and 1939 by the California Institute of Technology in San Josecito Cave, Nuevo León, Mexico, have yielded a large number of bird bones. This material is now in the hands of Dr. Loye Miller, of the University of California at Los Angeles, for examination. I am indebted to Dr. Miller as well as to the California Institute of Technology for the opportunity to study and report upon the thirty or more bones of caracara that are included in this collection.

According to Dr. Miller (MS), the cave deposit is Pleistocene in age, the avifauna closely paralleling that of Rancho La Brea in California. It is not surprising, therefore, to find the caracara well represented, for it is an abundant type in the California Pleistocene.

In all structural characteristics the bones from the cave resemble those of the Rancho La Brea species, *Polyborus prelutosus* (Howard, Carnegie Inst. Wash. Publ. no. 487, 1938, pp. 217-240). However, they are, on the average, shorter and broader. As previously observed (*op. cit.*, p. 221), there is in *Polyborus* a tendency to stoutness in the shorter tarsometatarsi and to relative slenderness in the longer ones. It is to be expected, therefore, that the tarsi from the cave, which average 7 per cent shorter than in *prelutosus*, should be found to be relatively broad as well. A similar tendency to greater breadth is found also in the ulnae and carpometacarpi from the cave, elements for which such a correlation of breadth and length has not previously been noted. However, in all measurements and ratios the cave specimens are found to overlap with *prelutosus* and it is, therefore, impossible to separate the Mexican bird specifically. The intergrading differences agree, rather, with our present conception of the subspecies. With the suggestion that, in the Pleistocene, the San Josecito avifauna was contemporaneous with that of Rancho La Brea, it is not unreasonable to assume the occurrence of two geographic races of the species *Polyborus prelutosus* at that time. Therefore, considering the California bird as *Polyborus prelutosus prelutosus*, the bird from northeastern Mexico is here described as

Polyborus prelutosus grinnelli new subspecies

Type.—Tarsometatarsus no. 2709, coll. Calif. Inst. Tech.; San Josecito Cave, southern Nuevo León, Mexico; Pleistocene.

Description of type.—Within range of variability of *Polyborus prelutosus prelutosus* except for shorter length and relatively greater breadth. Depression on internal side of shaft pronounced, but of less extent proximally and anteriorly than in extreme development of *P. p. prelutosus*; posterior contour angular with point of greatest depth 6.4 mm. below tip of calcaneum; distalmost foramen on posterior side nearly at border of intertrochlear space and 1.5 mm. below upper one. Length 77.2 mm.; shortest of series of eleven tarsometatarsi from this locality and 4.7 mm. shorter than smallest of series of 271 specimens from Rancho La Brea. Breadth relative to length: proximal end, 16.8 per cent; distal end, 18.2 per cent; shaft, 7.0 per cent; middle trochlea, 6.2 per cent. All ratios, except that for shaft, exceed maximum calculated ratios in *P. p. prelutosus*. Shaft ratio exceeded by other specimens from San Josecito Cave, however (see table).

Description of assigned material.—Series of ten cave tarsometatarsi (nos. 2710-2719, coll. Calif. Inst. Tech.) average 82 mm. in length, contrasted with 88 mm. for Rancho La Brea series, but with average ratios of breadth to length greater than in the latter. Characters of internal side of shaft and distal foramina include range of variation found in *P. p. prelutosus*.

Three cave ulnae (nos. 2723-2725, coll. Calif. Inst. Tech.) average 111 mm. in length, contrasted with 116 mm. for typical *prelutosus*. Though minima are nearly the same in both races, forty-one of fifty-two available specimens of *P. p. prelutosus* exceed the maximum for cave specimens. Ratios of breadth to length of ulna average greater in *grinnelli* than in *P. p. prelutosus*.

Specimens of humerus (nos. 2720-2722), tibiotarsus (nos. 2735-2736) and coracoid (no. 2737) all shorter than average for *P. p. prelutosus;* those of femur (nos. 2731-2734) and carpometacarpus (nos. 2726-2730) with maximum equal to average for *P. p. prelutosus*. Relative breadth of humerus,

tibiotarsus and femur tends to approximate average of *P. p. prelutosus*; depth of head of coracoid slightly greater; trochlea of carpometacarpus relatively broader and deeper.

The one complete humerus shows contour of bicipital crest well-rounded, with broadest point near scar of infraspinatus; crest curves into shaft at intermuscular line bordering bicipital surface. Pneumatic fossa, above level of bicipital crest, with "step" between fossa and crest. Distal end with well-marked ectepicondylar process and ridge distal thereto, as in type of *P. p. prelutosus*.

Area below articular surface on posterior side of tibiotarsus, faintly ridged but unexcavated, agreeing with eighteen specimens of typical *prelutosus* from Rancho La Brea.

Variability of femur, in curvature and rugosity, similar to that in *P. p. prelutosus;* none with trochanteric portion as little flared as in *P. cheriway*.

Area surrounding pisiform process, in carpometacarpus, excavated, with crest-like character of trochlea evident; variability as in typical *prelutosus*. One specimen with posterior contour of external ridge of trochlea intact, showing equal development of potentially prominent points. Same specimen showing inward curved process of metacarpal I; notch between process and trochlea anterior to their junction.

In proportion to lengths of other limb elements, tarsometatarsus of cave bird appears relatively somewhat shorter than that of typical *prelutosus*. However, with limited amount of Mexican material available, this not definitely ascertained.

The occurrence of this southerly race of *prelutosus* in the Pleistocene raises the question of the subspecific allocation of the Florida fossils assigned to *P. prelutosus* (Howard, *op. cit.*, pp. 237-238). Although the Florida bones are incomplete, there are several specimens the measurements of which lead to the conclusion that *Polyborus p. prelutosus* is the race represented. These are: (1) An ulna with length approximately 123 mm. (nearly 10 mm. greater than the maximum for *grinnelli*); (2) three ulnae with breadth of shaft less than any available specimen of *grinnelli* (the shaft in the Mexican race averages actually, as well as relatively, broader than in *prelutosus*); and (3) two tarsometatarsi with breadth of middle trochlea less than the minimum for *grinnelli*, but within the range of *prelutosus*.

Possible measurements on the few specimens of *prelutosus* from the Quaternary deposits of Conkling Cavern, New Mexico (Howard, *op. cit.*, p. 237), are all within the overlapping range of the two races and cannot, therefore, be given subspecific allocation.

As caracaras evidently were common birds in the Pleistocene, it is to be hoped that future discoveries will throw more light on the question of distribution of the races of *Polyborus prelutosus*.

MEASUREMENTS IN MILLIMETERS
(ratios in per cent)

Coracoid

	a Length	b Height proximal end	c Least depth head	Ratio b to a	Ratio c to a
P. p. grinnelli no. 2737	45.5	17.5	2.9	38.2	6.4
P. p. prelutosus					
minimum	43.6	17.2	2.0	36.6	4.7
mean	47.0	18.0	2.7	38.6	6.0
maximum	50.0	19.0	3.3	41.2	7.0

Humerus

	a Length	b Breadth distal end	c Breadth shaft	Ratio b to a	Ratio c to a
P. p. grinnelli					
no. 2720	.....	17.7	8.3	.....	.....
no. 2721	105.3	18.2	8.3	17.2	7.9
no. 2722	105.6	.....	8.0	.....	7.5
P. p. prelutosus					
minimum	100.3	17.0	7.9	16.2	7.2
mean	109.1	18.6	8.5	16.8	7.7
maximum	115.3	19.6	9.4	17.4	8.3

Ulna

	a Length	b Breadth proximal end, diagonally	c Breadth distal trochlea	d Breadth shaft	Ratio b to a	Ratio c to a	Ratio d to a
P. p. grinnelli							
no. 2723	109.1	14.7	8.2	6.2	13.4	7.5	5.6
no. 2724	111.4	14.6	7.7	5.8	13.1	6.9	5.2
no. 2725	113.5	14.8	8.0	5.8	13.0	7.0	5.1
P. p. prelutosus							
minimum	109.9	14.1	7.4	5.0	12.3	6.4	4.4
mean	116.0	14.9	7.9	5.7	12.6	6.8	4.8
maximum	122.3	16.3	8.7	6.1	13.4	7.2	5.1

Carpometacarpus

	a Length	b Depth trochlea	c Breadth trochlea	d Breadth shaft	Ratio b to a	Ratio c to a	Ratio d to a
P. p. grinnelli							
no. 2726	.....	14.7	.....	5.9	.....	.....	.....
no. 2727	57.6	15.4	6.1	5.3	26.7	10.5	9.2
no. 2728	59.8	15.2?	6.1	5.5	25.4?	10.1	9.2
no. 2729	60.6	.....	.....	5.7	.....	.....	9.4
no. 2730	63.4	.....	.....	5.8	.....	.....	9.1
P. p. prelutosus							
minimum	57.8	14.6	5.5	5.2	23.6	9.0	8.5
mean	63.1	15.7	6.1	5.6	24.8	9.4	8.9
maximum	67.8	17.0	6.6	6.2	25.7	10.1	9.4

Femur

	a Length	b Breadth proximal end	c Breadth distal end	d Breadth shaft	Ratio b to a	Ratio c to a	Ratio d to a
P. p. grinnelli							
no. 2731	61.1	15.8	13.8	7.0	25.9	22.6	11.4
no. 2732	62.8	15.7	.....	6.3	25.0	.....	10.1
no. 2733	63.0?	15.2?	.....	7.1	24.1?	.....	11.2
no. 2734	65.5	16.6	14.0	7.5	25.3	21.4	11.4
P. p. prelutosus							
minimum	61.7	14.5	13.2	6.5	23.0	20.0	10.0
mean	65.5	16.4	14.7	7.2	25.9	22.4	11.0
maximum	72.8	18.0	16.4	8.0	27.1	24.1	12.5

Tibiotarsus

	a Length	b Breadth proximal end	c Breadth distal end	d Least breadth shaft distal to fibula	Ratio b to a	Ratio c to a	Ratio d to c
P. p. grinnelli							
no. 2735	103.6	11.8	12.8	6.3	11.4	12.3	49.2
no. 2736	104.1	12.4	12.3	6.4	11.9	11.8	52.8
P. p. prelutosus							
minimum	100.5	11.7	12.2	6.2	11.0	11.4	47.5
mean	106.2	12.3	12.9	6.5	11.5	12.1	50.8
maximum	112.3	13.0	13.8	6.9	12.0	12.6	53.0

	Tarsometatarsus								
	a Length	b Breadth proximal end	c Breadth distal end	d Breadth shaft	e Breadth middle trochlea	Ratio b to a	Ratio c to a	Ratio d to a	Ratio e to a
P. p. grinnelli									
no. 2709									
(type)	77.2	13.0	14.1	5.4	4.8	16.8	18.2	7.0	6.2
no. 2710	78.1	.....	13.9	6.1	5.0	.....	17.8	7.8	6.4
no. 2711	80.0	12.1	13.1	5.3	4.8	15.1	16.3	6.6	6.0
no. 2712	80.8	13.0	14.0	6.4	5.0	16.1	17.3	7.9	6.1
no. 2713	82.2?	.....	14.5	5.5	5.3	.....	17.6?	6.7?	6.4?
no. 2714	83.1	12.7	13.6	6.0	4.9	15.2	16.3	7.2	5.9
no. 2715	83.4	.....	12.8	5.6	.....	.....	15.3	6.7	.....
no. 2716	83.9	13.1	14.3	5.8	5.0	15.8	17.0	6.9	6.0
no. 2717	84.4	13.2	14.1	5.5	5.2	15.6	16.7	6.5	6.1
no. 2718	85.4	12.9?	13.8	5.2	.....	15.1?	16.1	6.1	.....
no. 2719	85.6	.....	14.1	5.9	5.2	.....	16.4	6.9	6.0
mean	82.2	12.8	13.8	5.7	5.0	15.7	16.6	6.9	6.1
P. p. prelutosus									
minimum	81.9	12.1	13.0	4.8	4.4	13.4	14.4	5.3	4.9
mean	88.6	13.1	14.4	5.4	4.9	14.7	16.2	6.1	5.6
maximum	94.8	14.0	15.5	6.0	5.5	16.1	17.4	7.1	6.0

The new subspecific name is chosen in honor of the late Professor Joseph Grinnell who did so much to clarify the concept of the subspecies and its significance in evolution.

Los Angeles Museum, Los Angeles, California, November 14, 1939.

A HYBRID BETWEEN ZONOTRICHIA CORONATA AND ZONOTRICHIA LEUCOPHRYS

WITH TWO ILLUSTRATIONS

By ALDEN H. MILLER

The head markings of Golden-crowned (*Zonotrichia coronata*) and White-crowned (*Zonotrichia leucophrys*) sparrows are so strikingly different in nuptial plumage that question seldom arises about the identity of these species in mixed spring flocks in California. It was with decided interest, but not without doubts, that I responded to an invitation of Mr. Charles G. Thompson to verify the characters of a crowned sparrow feeding about his yard that he said showed features of both species. When I called at his home at 587 Arlington Avenue, Berkeley, the bird was in sight and the mixed characters were in evidence, just as Thompson had described them. The sparrow had the four black crown stripes of *leucophrys* sharply defined, but also it had the full-sized gold patch of *coronata*. It appeared large, and several times it drove the smaller White-crowned Sparrows from the grain scattered on the ground, once tangling in a brief, vigorous fight in which it was the victor.

Although Mr. Thompson was much interested in watching the bird about his place, he assented to its capture alive for purposes of close study. The bird had been first seen about April 1, 1939. By April 19, after several days of trapping, we were able to secure it. It was photographed in color and in black and white and then placed in a large cage with the intent of holding it over the summer period so that the winter plumage could be studied. Unfortunately the bird died on May 24 while I was out of town. The skin and skeleton were salvaged and now are no. 77233, Mus. Vert. Zool.; the bird was a male with fully developed gonads.

Because the head stripes of the hybrid correspond in the supra-orbital and loral areas to those of *Z. l. gambelii*, detailed comparison of the hybrid has been made with that race of White-crowned Sparrow. Also, of all races of *Z. leucophrys*, *gambelii* is most likely to meet *coronata* in the breeding season.

The black crown stripes of the hybrid are narrow as in *gambelii*, and they are terminated posteriorly by a gray stripe that extends back from the superciliary region. Lateral black stripes, normal for *gambelii*, run posteriorly on to the nape below and behind the lateral gray stripe. Anteriorly the dorsal black stripe does not meet the eye and does not invade the loral region as in the nuptial plumage of *coronata*. In all respects, then, the distribution of the black is that of *gambelii* with no influence of *coronata* manifest. In many fall-taken specimens of *coronata* the black is incompletely developed and the superciliary region is grayish (see Mailliard, Condor, vol. 34, 1932, pp. 66-70). However, the black or brown when present in such birds is limited to a narrow, tapered penciling on the crown, quite unlike the form of the stripe in breeding *gambelii* and in the hybrid. Even in fresh nuptial plumage, *coronata* may show traces of a gray superciliary line, but this consists merely of ephemeral white tippings on the black feathers of this region. In the hybrid the feathers of the superciliary stripe are white to their downy bases. Thus, the pattern of the hybrid's crown is not explicable as a feature of immature or retarded plumage of *coronata*.

In the coloration of the head, apart from the black stripes, the hybrid is predominantly *coronata*. In the central area of the crown, the gold extends backward to normal degree and it is not in the least diluted by mixture of gray or white. The gold is brighter than in many *coronata* of early spring, but no brighter than in certain breeding individuals. The posterior light areas of the crown and nape are gray, not white as in *gam-*

belii. Only in the superciliary stripe is the gray lighter, suggesting *gambelii* influence, but even here the tone is much closer to that of the lower lores and occiput of *coronata* than to the pure white of *gambelii*.

Above the eye of the hybrid, in the superciliary stripe, is a small patch of gold. This mark, which is not found in the nuptial plumage of either parental species, evidently results from the elimination of black from the superciliary area, thereby permitting the appearance of gold which otherwise is suppressed or obscured. The stripe pattern of *gambelii* has made possible the appearance of the gold of *coronata* in an unusual region. The gold spot is not situated anterior to the eye as is the yellow of the White-throated Sparrow *(Zonotrichia albicollis)*. This fact, the curvature of the lateral black stripes on to the nape and the presence of gold in the median area seem to preclude *albicollis* as a possible parent of the hybrid.

Fig. 13. Hybrid between *Zonotrichia coronata* and *Zonotrichia leucophrys*. The gold areas show as dark gray. Photograph by Elmer C. Aldrich.

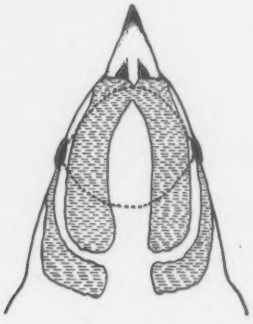


Fig. 14. Diagram of hybrid, showing pattern of black and circular area in which yellow pigment is present.

The gold of *coronata* results from a yellow carotenoid pigment in the rami throughout most of the pennaceous part of each feather together with small deposits of melanin in the tips of the barbules. The melanin seems to alter the color effect, producing gold instead of pure yellow. That the yellow pigment is a carotenoid is shown by its susceptibility to extraction in fat solvents, especially CS_2.

Immature Golden-crowns display a nearly circular area of clouded or mottled gold on the top of the head. This touches the orbits laterally and extends from the base of the culmen back through the crown area. In various stages intermediate between this and the full nuptial pattern (Mailliard, *loc. cit.*), black or brown restricts the yellow, but even in full nupial plumage it may leave minute yellowish tips on black feathers near the eye. Such traces frequently can be found if careful search be made. A semi-albino of *coronata* (no. 51864, Mus. Vert. Zool.) has the black of the crown suppressed except for a few pure black feathers posteriorly. The circular yellow patch is thus fully exposed, and more plainly visible than in immatures.

It became apparent that the complete circular area of yellow pigment might always be present in *coronata*, but variously obscured by black. To test this hypothesis, pure black feathers of the nuptial plumage of *coronata* were removed from the supposed circle of yellow. These were treated with hydrogen peroxide (H_2O_2) to bleach the melanin. As the melanin disappeared from the rami, clear yellow pigment was revealed identical

in appearance and position with that of gold feathers. The treated feathers varied macroscopically from bronze to gold, depending upon the amount of residual melanin in the barbules. Where melanin was bleached from certain basal rami, that in yellow feathers are pigmentless, the result was pure white. We may conclude that the black feathers had in them, completely obscured, a full complement of yellow carotenoid distributed in normal fashion. For assistance in the study of the pigments I am indebted to Mr. Frederick H. Test.

The color of the dorsal surface of the hybrid, back of the nape, is typical of *coronata*. Below on the throat and in the center of the belly, the hybrid is whiter than any *coronata*, evidently reflecting the *gambelii* influence, but the chest and sides are darker than in *gambelii*. As a result, the ventral coloration is less uniform beneath than in either species. The chest band tends to be mottled white and dark gray.

The bills of spring-taken *coronata* are dark brown dorsally whereas those of *gambelii* are pinkish except at the tip. The hybrid's bill is most like *gambelii*, although the pink is perhaps duller than usual and the black tip especially large.

Measurements of fifty males of each of the parental species are here tabulated for comparison with the hybrid. The wing and tail of the hybrid fall far below the range of variation for *coronata*, even below the average of *gambelii*. The dimensions of bill and feet, however, are typical of *coronata* and in some instances fall on or above the maximum for *gambelii*. It is remarkable that the measurements are not more generally intermediate between the means for the two species. However, there is doubtless much heterozygosity among factors controlling dimensions in both species and the chance combination of variables of the two species would permit an assortment of characters such as that found in the hybrid.

MEASUREMENTS OF MALE ZONOTRICHIAS IN MILLIMETERS

	Hybrid	50 *Z. coronata*		50 *Z. l. gambelii*	
		Average and standard deviation	Range	Average and standard deviation	Range
Wing length	75.5	81.33 σ 1.39	78.5-85.0	78.49 σ 2.09	73.0-82.5
Tail length	72.5	79.05 σ 2.06	74.5-83.0	73.16 σ 2.21	69.5-78.5
Bill length	8.5	8.41 σ 0.28	7.7- 9.0	7.81 σ 0.30	7.2- 8.5
Bill depth	7.0	7.01 σ 0.24	6.4- 7.6	6.42 σ 0.23	6.0- 7.1
Tarsus	23.6	24.18 σ 0.65	22.7-25.4	22.30 σ 0.69	20.9- 2.36
Middle toe	14.1	14.18 σ 0.44	13.3-15.4	13.11 σ 0.46	11.8-14.2
Hind toe	9.6	9.67 σ 0.38	8.8-10.8	8.56 σ 0.36	7.8- 9.1
Claw of hind toe	6.9	6.71 σ 0.40	6.0- 7.6	6.41 σ 0.40	4.9- 7.6

Linsdale and Sumner (Univ. Calif. Publ. Zool., vol. 40, 1934, p. 312) give weights of twenty-five Golden-crowned Sparrows of mixed sex taken in early April as 27.5 to 38.5 grams (average 32.8). Somewhat comparable figures for nineteen *gambelii* are 21.1 to 29.6 grams (average 25.4). The hybrid weighed 33.6 grams five days after its capture, at which time it was in good condition.

While the hybrid was in captivity much interest attended the character of its notes. After a few days of adjustment to its cage, it began singing with full power. The pattern, quality and pitch were typical of the Golden-crown. One can no more than speculate on the reason for this. There is in my mind doubt that the song is completely hereditary in all its elements. Was this hybrid raised in a community dominated by Golden-crowns, with perhaps its own male parent of that species?

Little can be concluded from this hybrid concerning the inheritance of characters of *coronata* and *leucophrys*, particularly since it is not certain, even though probable, that the bird is of the first hybrid generation. Nevertheless, we may be sure that sepa-

rate factors exist for head pattern and color. It seems likely that pattern and presence or absence of yellow are controlled by few factors and also that gold is dominant over absence of gold, that a pattern of two stripes (on one side) is dominant over single stripe, and that *coronata* back coloration is dominant. As already suggested, the measurements of the hybrid may result from chance combination of numerous factors for dimensions present in the parental species.

Throughout much of northern coastal Alaska and northern and central British Columbia, *coronata* and *gambelii* breed in the same geographic areas. *Coronata* nests in the Hudsonian Zone in timberline scrub. Brooks and Swarth (Pac. Coast Avif. No. 17, 1925, p. 92) state that *gambelii* in the northern part of British Columbia "is confined to the lowlands (Canadian zone); in the southern part of the province it breeds from Transition to Hudsonian (timber line)." It is in the latter situation, possibly where meadows and willow thickets reach timberline, that the breeding habitats of the two species may occasionally be contiguous. Possibly because of the rarity of such situations, or perhaps even more because of lack of compatibility as regards breeding when the two are thrown together, hybridization has not occurred to such an extent that it has been detected before. I find in the literature and in available specimens no evidence of interbreeding of these two strikingly different species other than that embodied in the specimen here reported.

Museum of Vertebrate Zoology, Berkeley, California, November 15, 1939.

OBSERVATIONS ON THE BEHAVIOR OF COLOR-BANDED CALIFORNIA THRASHERS

WITH THREE ILLUSTRATIONS

By GRACE TOMPKINS SARGENT

The following observations on California Thrashers (*Toxostoma redivivum*) were made from November 8, 1935, to June 2, 1936, and from September 16, 1936, to June 1, 1937, at 241 South Holliston Avenue, Pasadena, California. My banding station was located on the open balcony of our rear second-story apartment. From this balcony and the windows of the apartment, I was able to identify with field glasses color-banded birds over an area of approximately 32,000 square feet, or about three-quarters of an acre, comprising seven back yards of neighboring residences.

These casually gardened yards were situated in a pleasant old residential district. Bounded on the east and west by houses, they contained the usual human paraphernalia of cement driveways, garages and sheds. In addition was a varied and favorable bird environment: a dense cypress hedge 15 to 20 feet high and 5 feet thick, which supported many nests, a 50-foot cypress tree, three large untrimmed Washington palms, several large oaks, seven walnut trees, and numerous citrus and deciduous fruit trees. An abandoned dirt tennis court and several fence corners grew abundantly to weeds; morning-glory and honeysuckle vines flourished on two garages and on an old barn. Flower plots, low hedges and dense shrubs completed the picture. Each of the yards had an available water supply, either dripping water faucets, bird baths, or small fish ponds.

The winter of 1935-1936 was mild, even for southern California, with moderate rains and few frosts. The winter of 1936-1937 was one of record cold. From Christmas to March, night frosts were almost continuous. Plant damage was heavy.

In spite of the fact that children and adults, cats and dogs, and automobiles, frequently occupied the area, a large and healthy bird population maintained itself. Common resident species, beside the thrashers, were Western Mockingbirds, Song Sparrows, Brown and Spotted towhees, and California Jays. A flock of California Quail used the yards as part of their feeding ground and at least two pairs nested in it. House Finches and Gambel Sparrows were periodically numerous; Brewer Blackbirds became numerous the second spring. A Sharp-shinned Hawk was seen in the area only once, when it attacked a trapped sparrow on the balcony. Human residents were indifferent or mildly friendly to the birds. Pet cats were the chief enemies of birds.

Fig. 15. View east from observation post on balcony. Black spot in hedge marks site of nests A, B, and D.

Fig. 16. View southwest from balcony, showing west ends of yards 241 and 247.

Two-cell W.B.B.A. traps were placed in the window boxes of the balcony and baited with walnut meats. Food was always offered outside as well as inside the traps. During the second year, the thrashers fed and bathed frequently in the window boxes; occasional repeats to the traps enabled me to check the bands. Homemade colored celluloid bands were used, one to a bird in addition to the Biological Survey band being sufficient for identification because of the small numbers of individuals studied; the colors were still distinct at the end of the period of observation. In the following discussions, the individual birds are designated by the color and position of their bands.

CHRONOLOGY OF THRASHERS FROM NOVEMBER 8, 1935, TO JUNE 1, 1937

AP Female B-317147 — Banded Nov. 25, '35. Last seen Dec. 29, '35, feeding with White and two young in yards.

White Male A-433227 — Banded Nov. 27, '37

AG Droop-wing Female A-373203 — Banded March 24, '36. First seen Jan. 4, '36. Gradually accepted as mate by White.

Nest A

In dense cypress hedge. Nov. 8, '35, parents carry food to nest. Two young first seen out of nest Nov. 26.

RA Im. A-373202 banded Feb. 18, '36. March 10, '36, White chased from yards; last day seen.

Unbanded, lived in yards at least until Feb., '36.

Nest B

Feb. 20, '36, White carried twig to same location as Nest A. March 19, nest deserted.

Nest C

White first seen carrying insect west of old barn May 1, '36.

AY Im. B-317155 Rescued from cat and banded while White nearby May 19, '36. Not seen again.

(No observations from June 2, 1936, to Sept. 16, 1936. On return in September, White and Droop-wing constantly seen in yards until Feb., 1937, but no nest building activity.)

Nest D

Feb. 19, '37, White and Droop-wing both carry nesting material to same location as Nests A and B.

YA Im. 35-337330 Banded April 7, '37, few days out of nest. Mauled by cat April 10. Died April 12.

Feathers found later; killed by cat about April 7, '37?

Nest E

Droop-wing carried twig April 8, '37. May 5 Droop-wing and White both carried insects south of house at 255.

Unbanded. First seen out of nest May 20, '37. In company of White when observations discontinued June 1, 1937.

Chronology.—All the thrashers resident in the area formed one family. One adult male (White) was present during the entire period. With the help of his mate (AP) he successfully raised two young thrashers during November, 1935. AP disappeared about December 29, 1935, and within a week a new female appeared (AG Droop-wing). This bird was clearly distinguished in the field, even before banding, by a permanent disfigurement of seven primary feathers in her left wing which were set at a slight angle to the rest of the feathers, but which did not hinder her materially in flying or in other normal activities. After several weeks, Droop-wing was accepted by White as his new mate. The sex of the birds, which were identical in plumage, was established when Droop-wing many times assumed the female mating position. I once saw Droop-wing

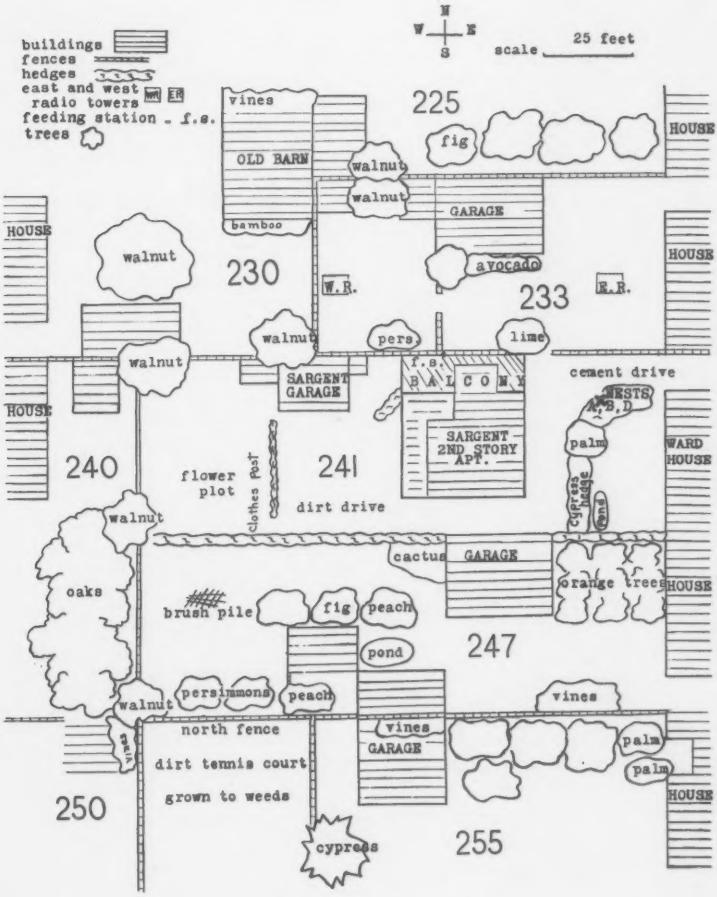


Fig. 17. Map of area in which color-banded thrashers were observed.

mounted, but was not able positively to identify White as the mounter. During the spring of 1936 and the spring of 1937, Droop-wing and White were observed to build four nests; they were still occupying the area when I left on June 1, 1937.

Chasing of new female.—Female AP remained in the yards during December, 1935, in company of White and the two young birds of the November nest (A). She was never heard to utter any note except the warning *chup* note. On December 29, 1935, she fed about the yards as usual, but she was never seen after that day.

On January 4, 1936, I first recorded a thrasher "with drooping primaries" which was vigorously chased from yard 241. On January 6 White was seen in full chase after this unbanded thrasher. White was a couple of feet behind Droop-wing who twisted and turned, doubling back occasionally. White chased Droop-wing north out of yard 233; then he fed south to the cypress at 255 and sang. Shortly, Droop-wing reappeared, ran directly *toward the singing* and was again chased north of 233. This alternate chasing and returning continued all day. Both birds *chupped* frequently.

The next day, after a chase, White flew to the Ward palm and sang; Droop-wing then reappeared on the old barn and warbled a note or two.

On January 9, while White sang from 255, Droop-wing *also sang loudly and sweetly* in 230. Later, after another chase, White fed in the old tennis court and, a few feet away, Droop-wing also fed.

On the 10th, in a tree in front of the house at 225, I saw Droop-wing perched with head and tail uptilted, fluttering her wings slightly. About three feet away, a second thrasher, which I could not see, sang softly.

The following day, after a slow chase north from 255 to 241, White stopped to feed, and Droop-wing also stopped, fluttering her wings with head and tail up at a sharp angle. White again charged at her, Droop-wing dodged, and they ran in circles within yard 241, finally disappearing northward.

On January 15, I started watching the thrashers at 7:45 a.m., when White and Droop-wing fed about 10 feet apart in 247. At 8:30, White chased Droop-wing around in circles about 15 feet in diameter in yard 241; they kept this up without stopping for 12 round trips. Ten minutes later both were feeding 15 feet apart in 247. At 9:35, White flew to the Ward palm and sang, loudly and sweetly. In a lull in his song, I heard a short song from Droop-wing from the fig tree in 225. She flew down and a minute later appeared on the east radio tower in 233, hopping nearly to the top. She was now only about 30 feet from White, at about the same height, and in plain sight. White continued to sing, but he commenced to move about in the palm. Droop-wing perched on the radio tower and began a counterpoint somewhat softer than White's song. *Both sang for about fifteen minutes.* Droop-wing then stopped singing and sat quietly for ten minutes longer, vibrating her wings with a slight, rapid movement. White moved about from the palm to the cypress hedge, finally singing from the site of Nest A. Droop-wing uttered a few more notes of song. Suddenly, White's song ceased and he flew directly at Droop-wing on the radio tower. With a squawk, she flew to the garage roof in 233, White in pursuit. Both ran across 225 and disappeared north.

On the 16th and 17th, White sang vigorously, but I saw no chases. On January 21, Droop-wing was chased briefly. On the 22nd, Droop-wing gave a short harsh song on the east radio tower, then flew north. During the rest of January, White and Droop-wing were frequently seen feeding in the same yard. On several occasions White chased Droop-wing for a few feet, but in each case they shortly resumed feeding.

On February 4, White picked up a piece of bermuda grass and dropped it again. On the 5th he repeated this, singing in the Ward palm with the "sweetness of a rusty saw." On February 20 he carried a twig into the cypress at the point of Nest A. During

the month from February 5 until March 6, White was not once observed to chase Droop-wing, although both adults frequently chased the young thrashers of the November brood.

On March 6, Droop-wing uttered a few squeaky notes and later fluttered her wings slightly and preened. White chased her several times this day and two days later, when she again sang a few notes. On March 10, White chased Droop-wing briefly, and after a long pursuit finally drove out young RA. White was never again seen to chase Droop-wing. Hereafter they fed quietly, close together, as had White and his first mate AP. On March 12, 1936, they both carried twigs into the cypress to start Nest B, and throughout the rest of the period until June 1, 1937, they lived in the yards in a close partnership.

Chasing of young thrasher.—During the first two weeks of January, 1936, I continued to see the two young thrashers of Nest A in the area. These unbanded young could still be distinguished by their scraggly feathers and a characteristic hunched posture not exhibited by the adults. They fed independently about the yards and took no part in White's chases of Droop-wing; the adult birds had up to this time paid little attention to them.

On January 20 I noted: "Young thrasher feeding under persimmon 247 when Droop-wing thrasher makes short rush at him—young thrasher gives ground and continues feeding under walnut in corner. . . ."

On January 24, White suddenly chased a young thrasher energetically about yard 247. The following day White chased Droop-wing in circles in 247 and 255, while a young thrasher kept out of the line of fire; later White chased a young thrasher in 247, then sang in 255.

From this time on into February, White devoted more time to the chasing of the young thrashers, and less to the chasing of Droop-wing. He sang often and vigorously from all parts of the yards. The chasing of the young birds varied considerably. Sometimes White pursued a young bird in short rushes through a couple of yards; at other times, after flying directly at a young bird, and occupying his position, White would resume feeding. Droop-wing chased a young thrasher but once.

On February 18 a young thrasher finally entered the trap; White remained nearby while he was banded (RA). I recorded RA as still having a few juvenal feathers. This same day White flew into the cypress with a long stick in his bill.

On February 19 White chased RA mildly in yard 247, but they soon fed. The second young bird, still unbanded, was also seen feeding. During the following days, White continued to carry sticks into the Ward cypress, and to sing actively. RA and the young unbanded thrasher, as well as Droop-wing, were seen often about the yards, feeding. RA was chased mildly February 26, and vigorously the evening of the 28th on the house roof in 255.

On March 10 at 9:10 a.m., White chased Droop-wing briefly in 247 and 241. At 10:30 I saw Droop-wing chasing RA round and round in the walnut trees in 230. A moment later Droop-wing was on the old barn, *chupping*, and White and RA were in 230. A twenty minute chase began, in which White pursued RA through the tree tops with scarcely a pause. They flew from 230 to 240, back to 230, then directly northward to about 215. RA doubled back to 230, was chased northward again to 215. Again he flew back to the trees in 230, was chased to 233, to 240, back to 230. Here White and RA paused, then both flew south into 240 and disappeared in the trees. Droop-wing now appeared feeding on the ground in 230. Shortly after, White joined her and they fed peacefully a few feet apart.

About two hours later I saw RA feeding for a moment in 230 west of the old barn. This was my last record of RA.

Nest A.—When observations on the thrashers were begun in November, 1935, the two adults were carrying food to the nest in the cypress. They carried food daily from November 8 to 16; brief songs were heard on the 12th and the 16th. On the 22nd I counted three Jerusalem crickets carried to the cypress by the adults within an hour and a half. On the 24th, an adult on our roof sang squeakily through a cricket, gulped it down, and continued singing.

Female AP was trapped and banded on November 25. The next day I first saw a young bird with one adult. It cheeped and the adult fed it. It ran rapidly, but did not seem able to fly much.

On November 27, the male, White, was trapped and banded. Later that day I saw him accompanied by a young thrasher whose tail was still short and held at an angle, and its bill slender, shorter and not so curved as that of his parent. The next day I discovered that there were *two* young thrashers: "Could clearly see both of them in 247. AP was feeding one. Then both parents fed, then one parent fed both babies. Babies kept as close as possible to parent, twittering, with mouths open. Parent occasionally ate an insect itself."

On December 4, 1935, AP, followed by a young bird, ran rapidly east in 247 and flew up on the garage in yard 247. The young bird flew easily. Ten minutes later White was in 247, with a young bird following.

AP fed both young thrashers in 230 on December 15. The young birds also dug for themselves, but frequently begged of AP. This was the last day I saw the young birds fed, although they continued to accompany the adults about the yards the rest of December.

Nest B.—White first carried a twig to the same location as Nest A on February 20, 1936. On March 12, *both* White and his new mate Droop-wing carried weeds to the nest. On March 19, our neighbors the Wards cut six feet off the top of the cypress hedge, exposing the nest. On March 24, I first captured Droop-wing, whom I had seen constantly about the yards since January, and color banded her *AG*. Her belly was swollen and bare of down feathers and the anus was protruding and swollen, as if she were about to lay eggs or was incubating. The flesh was healthy and firm. Later the same day, White dug up a fat worm and ran with it near the cypress. However, no further nesting activity was observed at the cypress at this time or until the following spring, when the hedge had grown back to its original height.

Nest C.—During April, 1936, I saw little of White and Droop-wing. On May 1 and May 9, White carried insects west of the old barn. On May 10 he *chupped* vigorously at a cat in 233, picked up worms, carried them about and then swallowed them, and also gave a high plaintive *whew kew* note I had never heard before. Droop-wing remained nearby, uneasy but silent. On May 19 I heard a thin, shrill squeaking in 233 and mockers, thrashers, brown towhees, and grosbeaks immediately collected, scolding furiously. I ran down at once and grabbed a young thrasher out of the clutches of a cat. Although breathing hard, it showed no sign of injury, and it was banded AY. When released, the juvenile climbed into a hedge by the balcony and sat there for several hours, during which time it was fed by White. I never saw it again.

On May 23, a week before we left for the summer, I saw White fly directly against Droop-wing in 230, fluttering his wings, but could not be certain that he mounted her.

Nest D.—White and Droop-wing spent the fall and winter of 1936 quietly feeding in the yards. On February 15, 1937, I noted White in vigorous song. On February 19 Droop-wing and White *both* were seen carrying long twigs into the cypress, just about

where the nest was in November, 1935. The following day White silently chased a *chupping* unbanded adult from 241 and 230. On February 23 both White and Droop-wing carried large loads of fine material to the nest. They worked quickly and silently—several loads were carried in fifteen minutes. One of Droop-wing's loads was fibrous, like shreds from palm fronds; she picked this material off the ground in 233. White sang three times from 233.

On February 25 White gradually and silently chased an unbanded adult southeast from yard 240 into yard 255. The next day the pair wandered through 233, picking up very fine stems and fibers—both carried a good load to the cypress. On March 2, after singing energetically from several points in yards 240 and 247, White opened his beak as if gulping, then ran up to Droop-wing and touched her bill, which was also open, then both disappeared in 247. Two days later the pair fed unhurriedly about yard 247, Droop-wing sunbathed, and White sang lazily, a syllable or two at a time.

A dramatic chase that lasted a good half hour occurred on March 5. Droop-wing was first seen chasing an unbanded slender-appearing adult thrasher in the walnut in 225; soon White joined the chase. The unbanded bird doubled and twisted time after time so that they chased up and down, and around and around in the same tree, all of them *chupping* steadily. Once or twice the pair succeeded in driving the intruder further north, but *twice* the bird was seen suddenly to fly directly to the nest site! Immediately White and Droop-wing followed and drove it forth again into 233 and hence eventually into 225, but it was an arduous process for all concerned. When last seen, all three birds were in the walnut in 225. Droop-wing made constant rushes at the unbanded bird, which as constantly retreated and doubled back in the tree. White alternated his chasing with perching and low song. *Droop-wing also sang a few notes.* The unbanded bird *chupped,* its bill open.

March 6 was a perplexing day. At 10 a.m. White sang in the walnut in 225, then flew to the east radio tower in 233 and into the cypress at x, the point of the nest. A moment later Droop-wing appeared here and flew into 233, where *she sang for some time,* not very loud or sweet but a legitimate song.

At 10:30 White and Droop-wing were about a foot apart in 233, digging vigorously. White got a Jerusalem cricket, pulled it out, mauled it about, hit it, and gulped down a leg or two. Then, while Droop-wing watched, he carried the insect to the nest! He was out almost at once into 225 where Droop-wing had meanwhile run. In ten minutes he returned to the cypress, while Droop-wing ran through the yards from 233 to 250. Then Droop-wing appeared in our walnut, singing loudly! *While Droop-wing sang in our walnut, an unbanded thrasher in the walnut in 240 hopped about, then tilted its tail and fluttered its wings.* Presently the strange bird flew down into 240. Droop-wing then flew down into 233 and dug there. White now flew out of the cypress, dug about in 233 then climbed to the top of the walnut in 233 and sang long and loudly. Droop-wing flew into the walnut and gradually hopped higher and higher until she was at the top—only about a foot from White, then she opened her bill. Both birds sat silently for a minute or two, then White flew down into 230. Droop-wing sat and *sang* for a couple of minutes longer. In the afternoon, about 2 p.m., Droop-wing sang loudly on the garage roof in 233. Later she *chupped* here, and White flew from the cypress onto the roof.

On March 7, Droop-wing and White were seen separately leaving and entering the cypress at x, their bills empty. In the afternoon Droop-wing uttered one short phrase of song.

On March 9, at 12:30 and 1:40 p.m., White approached the cypress from 233, whereupon Droop-wing flew out from x and he flew in. The second time, she lit near

him on the cement drive, crouched, elevated her tail straight up and fluttered her wings. He paid no attention, after a second flying into the cypress, and she fed in 233. In the afternoon, White twice sang loudly.

Again on March 13, White flew to the wire north of the cypress, and sat there a minute, uttering very soft *chucks*, scarcely audible. Droop-wing appeared at x and clung to an outer branch, vibrating her wings slightly, with head and tail tilted up. Then White hopped into the cypress and Droop-wing flew off southward. This alternation on the nest, one flying in as the other flew out, was also observed on March 16 and 19.

On March 21, for the first time since March 6, White flew into the cypress, as Droop-wing flew out, with a worm in his bill. On March 27, he twice flew into x with insects.

On March 30 White sang in 233, a few notes at a time; later Droop-wing and White joined in vigorous *chupping* at a cat near the cypress. On April 3, both White and Droop-wing carried insects high into the cypress. Later White sang in 233. On April 5, Droop-wing carried an insect to the same spot in the cypress.

A young thrasher, in company of White, was first seen out of the nest on April 7. It was captured and banded YA the same evening as it attempted to follow White on to the garage roof in 233. I saw it many times on April 8 and 9, following White and Droop-wing about the yards where it was fed by them. On April 8 the cypress was cut back again, exposing the empty nest. Two days later a cat cornered and clawed at YA before the clamor of the adults brought me to the rescue. The next two days, White and Droop-wing continued to feed this youngster, but although it showed no external sign of injury, it grew gradually weaker, sitting quietly with its wings drooped and its eyes closed. It finally died on April 12. A pile of immature thrasher feathers afterward found near the cypress indicated that a second young bird may also have been killed by a cat shortly after leaving the nest.

Nest E.—On April 8, 1937, I noted Droop-wing "carrying a long twig." On the day of YA's death, April 12, after attempting to feed YA in 247, Droop-wing wandered off and twice picked up a long stick and dropped it again. Six days later White silently chased an unbanded adult thrasher from yard 233 to the front of house 233. On April 23 White disappeared south of house 247 with a Jerusalem cricket in his bill. From April 24 to May 3, the two thrashers were seen occasionally, feeding separately; they were never seen together. On May 5 Droop-wing and White both carried insects south of the house in 255. White carried walnut meats to the vines in 247 and sang vigorously on May 19. The next day I first saw a young thrasher in 247; both White and Droop-wing fed it. This unbanded young thrasher, now well feathered, fed about the yards with White, and White sang, on the day we left, June 1, 1937.

Song and singing posts of male.—White sang during every month from November, 1935, through June, 1936. On our return in September, 1936, he was again observed in song. He sang in October, although this fall there was no nest building activity and only occasional chasing of strange thrashers. During November and December, 1936, and January, 1937, White and Droop-wing frequently fed about the the yards and several times chased strange thrashers. No singing was recorded in November; I noted White singing in December only once, and once in January heard a thrasher singing in the distance. Singing was heard February 11, 1937. On February 15 White was several times heard in powerful song. Four days later he started Nest D, and sang almost daily until we left in June, 1937.

Much of White's singing was done from the high points near nests A, B, and D—the palm, the east radio tower in 233, and the roof of our apartment. Other occasional

perches included all the high spots of the area such as roofs of garages, tops of fruit trees, the 15-foot fence of the tennis court and the 50-foot cypress tree in 255. It was seldom possible to distinguish White when he sang in this dense and distant cypress tree, but a number of times he flew, still singing, directly from the tree to nearer points. White did not fly to, or sing from, the roofs of the single and two-story houses which bounded the yards to the east and west, with the exception of the house in 255.

Thrasher singing was sometimes heard outside my area of observation and I have no way of proving that these distant singers were not White. No other thrashers except White and Droop-wing were ever observed to sing within the area.

Song of female.—The singing noted in the course of White's chasing of Droop-wing on March 8, 1936, was the last heard from her that spring. In the fall and winter of 1936, White sang on September 19, 20, 22 and 25. On the 25th, during a thick wet fog, Droop-wing also sang shortly and melodiously. Droop-wing sang once more that fall, on October 18. Her only singing during the spring of 1937 was on March 5, 6, and 7.

Feeding area.—The area in which White fed corresponded closely with the area in which he sang; foraging was often interrupted by singing, usually after hopping or flying to a high perch. Feeding was always on the ground except at my balcony station. When not disturbed by human and animal occupants of the yards, White and his mate and current offspring tended to follow habitual north and south routes through the yards in feeding, and I was often able to keep them under observation for long periods. Beside their insect and walnut diet, the thrashers acquired a taste for bread, raisins, and rotting persimmons.

Behavior toward animal associates.—On May 26, 1936, I was startled to see a large non-native rat run along the wire fence between yards 230 and 233. Droop-wing was feeding on the opposite side of the fence from the rat; as it approached her she raised her wings as if in defense and retreated slightly. The rat faced Droop-wing for an instant, then continued on its way. Droop-wing began to follow it, still on her side of the fence. The rat ran slowly to the end of the fence, then turned and retraced its steps. Droop-wing also turned and followed close behind it, her wings raised a little, but making no sound. The rat disappeared behind the old barn, and Droop-wing returned to her digging.

On April 2, 1937, I witnessed a fight between White and an alligator lizard about 9 inches long. These snake-like lizards are seldom seen in the residential district of Pasadena. The lizard faced the thrasher with head up and jaws open. White raised his wings slightly above his back, as Droop-wing did with the rat, then circled behind the lizard and grabbed its tail. The lizard twisted quickly and faced him, and White dropped the tail, springing back. Again White circled and darted in, jerking the lizard's tail until it got its head around. He repeated this over and over, until the lizard began to wriggle toward a nearby rubbish heap. White hastily followed and yanked it back, but each time the lizard worked a little nearer, until finally it reached safety. White hopped about, but could no longer reach it, and wandered off, digging.

Most of my records show a complete indifference on the part of thrashers toward other birds in the same area. Thrashers and quail fed past each other, rubbing shoulders, as if unaware of each other's presence. However, a few exceptions to this mutual indifference are noted below.

The walnut trees in the yards were a source of food supply for many species; when a flicker or a thrasher found an unopened nut and cracked the shell with hammering blows of its bill, the smaller finches, sparrows, and towhees frequently gathered round to snatch a few crumbs. Sometimes the thrashers were tolerant of such an intrusion,

sometimes not. Thus, on December 15, 1935, "When AP was digging vigorously, not only the young thrashers, but several finches and a blackbird gathered round to share in the spoils. AP several times ran at finches, chasing them away, and even a young thrasher did this."

Twice while White and Droop-wing had young in Nest D, I saw a thrasher fly directly at a jay in 233. The second time I identified the bird as White; he forced the jay to fly north into 225, then went on feeding in 233.

Droop-wing twice took a raisin from a finch on the feeding station, running at the smaller bird until it dropped the raisin, whereupon she ate it herself. Once, however, when she flew onto a window box she found it occupied by a pair of California Quail. The male turned and faced her and she quickly hopped off again.

Disputes with mockingbirds occurred on several occasions. On February 2, 1936, a color-banded mocker twice flew at a young thrasher in 247 and they pecked at each other in a little flurry for an instant, then separated and fed a few feet apart. The thrasher was digging in thick dead leaves here for fallen persimmons.

On November 16, 1936, while White and Droop-wing dug on the ground in 247, a mocker nearby found a large insect. The mocker pecked at the insect, lifting it quickly and dropping it and approaching it with wings partly spread. Suddenly White darted in, seized the insect, and flew away with it.

During April and May of 1937, the resident color-banded mocker included my feeding station in his territory and constantly drove finches, towhees and sparrows from it, scattering them like leaves as he darted on to the balcony. Several times he also attacked White and Droop-wing. White once defended himself vigorously. Thrasher and mocker rose sharply in the air in a flurry of feathers. They dropped to the balcony, returned to the air, and then White flew down into 233 and the mocker to a wire near the balcony. Droop-wing, when attacked, jabbed back with her bill or merely stood unmoving until the mocker retreated and left her to eat in peace.

DISCUSSION AND SUMMARY

1. Of five nests of the California Thrasher that were started, one was deserted at about the egg-laying stage. Five young from the other four nests are known to have successfully left their nests. Cats mauled two of these while they were still being fed by the adults, and this probably accounted for the death of one and the disappearance of the other. Two more young survived to maturity. The fifth was well feathered but still following the male parent when observations ceased.

2. Both male and female took active part in the gathering of nesting material, incubation, and care of young. A quiet period followed completion of the nest, before incubation was begun, in which the male and female were seen feeding together; perhaps mating took place in this period. Three times the male thrasher was observed carrying insects to the nest at the beginning of incubation. Male and female alternated in incubating the eggs, one flying out as the other flew in. The two young birds which survived after leaving the nest of November, 1935, were sometimes both fed by one parent. At other times each adult took charge of one young.

3. When the two young birds of the November nest became independent of their parents, White and AP, they were tolerated about the yards until a new nest was started. They were then chased with increasing vigor by their father, White, and occasionally also by White's second mate, Droop-wing. The banded young, RA, was finally forced to leave the area.

4. White had two mates; the second female appeared a week after the disappearance of the first. It seems possible from the abrupt disappearance of the first mate, AP,

before her offspring were completely independent, that she was killed. The male's vigorous chasing of the new female might have been caused by the interruption of the nesting cycle, the new female being regarded merely as an intruder rather than as a potential mate. It is less likely that the chasing was caused by the abnormality of the wing feathers of this new female. At any rate, once accepted, female Droop-wing remained as the mate for a period of a year and a half during which time she and White built four nests and lived, both in and out of the nesting period (as had White and his first mate, AP) in a close and peaceful partnership.

5. White sang throughout the year. He sang particularly vigorously during nest building, after the young were out of the nest, and during the chasing of his new mate. The chasing of his independent offspring RA and of strange thrashers were sometimes accompanied by loud song, sometimes silent. He also sang at periods when there was no nesting activity and when his song could be attributed to none of the above mentioned situations.

6. Female AP was never heard to utter any sound except the call note, *chup*; she was also never observed in any chases. Female Droop-wing, however, sang a number of times during the period in which she was chased by White, sometimes very sweetly. During the fall of 1936, she was twice observed to utter a few phrases of song when no chasing was noted. Her vigorous singing in March, 1937, was accompanied by vigorous chasing of a strange thrasher from the vicinity of her nest, and by wing fluttering and tail tilting of the strange thrasher. The rest of the period she was silent except for the *chup* note. A possible explanation of her singing might be a combined sexual and territorial urge, first, when a lone male drove her from his feeding and nesting area, and second, when a strange female attempted to invade that area.

7. During the nesting periods, with one exception, strange unbanded thrashers observed in the yards were chased from the yards by White, sometimes aided by Droop-wing. However, when the young birds were out of the nest, there seemed to be more toleration of strange birds, as both unbanded young and adults occasionally remained unmolested in the yards. In the fall and winter of 1936, when there was no nesting activity, both young and adult unbanded thrashers were now and then observed in the area. Sometimes these birds were unmolested; sometimes they were chased by White, or by both White and Droop-wing. It is quite possible that at least a portion of the young unbanded thrashers seen in the area after the nesting periods were unbanded young from Nests A and C, or even from a nest built during my absence in the summer of 1936. Strange birds in the yards were usually silent; a few times I heard a *chup*, but no stranger ever sang.

8. White was never observed in actual battle with another thrasher. There was never the border warfare constantly displayed by the color-banded Mockingbirds and Song Sparrows in the same yards. In these species, members of rival pairs faced each other bill to bill, with unmistakable hostile intent, occasionally rising in an actual pecking flurry before they separated and returned to their respective territories. With White in every case, whether it was a new mate, independent young, or strangers, there was a chase, in which the pursued offered at most only the stubbornly passive resistance of running in circles or of immediately returning to the area from which ousted. Although the extent of the chases varied from a few feet in length to a complete circuit of the yards, and in some cases, beyond them, White's right to attack was never disputed. Two possible explanations can be given for this lack of border warfare. The first is that the thrasher population, in this locality at least, was not dense enough to necessitate the enforcement of strict boundaries, and that therefore the size of White's territory

was somewhat elastic. A second explanation is that the territory extended beyond the yards, and that the boundaries were outside my range of observation. The paved streets on which the two rows of houses faced might have formed natural boundaries to east and west; to the north, a cross street was three yards from the observation balcony, at yard 210. To the south the houses extended in an unbroken line for about a third of a mile; here was the logical position for opposition and rivalry, and perhaps such rivalry existed south of yard 255.

At any rate, one male thrasher fed, sang and nested in, and often defended against intruders, an area of at least three-quarters of an acre throughout a period of two years.

9. Twenty-two years ago, Joseph Grinnell (Auk, vol. 34, 1917, p. 432) wrote: "The California Thrasher is a habitual forager beneath dense and continuous cover. Furthermore, probably two-thirds of its foraging is done on the ground. In seeking food above ground, as when patronizing cascara bushes, the thrasher rarely mounts to an exposed position, but only goes as high as is essential to securing the coveted fruits. The bird may be characterized as semi-terrestial, but always dependent upon vegetational cover; and this cover must be of the chaparral type, open next to the ground, with strongly interlacing branch-work and evergreen leafy canopy close above . . . ."

The California Thrasher is naturally a bird of the chaparral. But this paper serves to illustrate that the species is also satisfactorily adapted to life in residential districts. The color-banded birds which I studied have become accustomed to open yards and tree tops, to new sources of food, and to a new enemy—the house cat. They have met the competition of different species of birds, such as the Mockingbird, and they have successfully reared their young in this new environment. The brown bird with the long curved bill has become a familiar figure to the suburban dweller who has never known the chaparral.

La Jolla, California, September 8, 1939.

AN ANALYSIS OF THE SUBSPECIFIC STATUS OF DOWITCHERS IN CALIFORNIA

WITH ONE ILLUSTRATION

By ROBERT T. ORR

Recently, in the course of checking and arranging the shore birds in the collection of the California Academy of Sciences, the problem of subspecific identity of Dowitchers (*Limnodromus griseus*) collected in California presented itself. Concurrent with this was the nomenclatural problem involved which offered several alternatives: accord with Rowan (Auk, vol. 49, 1932, pp. 14-35) and consider the long-billed, western form, *scolopaceus*, a full species and the small-billed, more easterly breeding form, *hendersoni*, a subspecies of *griseus*; follow Brodkorb (Proc. Biol. Soc. Wash., vol. 46, 1933, pp. 123-128) and call the western and eastern forms *fasciatus* and *griseus*, respectively, considering them conspecific; accept the classification employed in the 1931 A.O.U. Check-list and by Peters (Check-list of Birds of the World, vol. 2, 1934, pp. 272-273) and refer to the western race as *scolopaceus* and the eastern race as *griseus*. In as much as the problem was rather involved and required considerable time and thought to arrive at any satisfactory conclusion, it seemed advisable to place such results and the facts upon which they were based on record.

In the series of 207 dowitchers from California in the Academy collection, supplemented by several pertinent specimens in the collection of James Moffitt, it was quite obvious and to be expected that two races or forms were represented. Two characters were found to be of outstanding value in segregating specimens into the groups involved. These were length of culmen and barring as against spotting on the sides of the chest in summer-plumaged birds. Certain other characters, although not so marked, proved of some value in this regard. To summarize, the characters of the two groups may be given as follows: the long-billed group, herein referred to as *scolopaceus*, is distinguished from the eastern form, designated as *griseus*, by greater length of bill (68 to 78 mm. for females and 52 to 66 mm. for males of *scolopaceus* as compared with 58 to 67 mm. for females and 52 to 61 mm. for males of *griseus*), relatively shorter wing, presence of bars rather than spots on the sides of the breast in summer plumage, more restricted buffy edging to the feathers of the back and the tertials, and by a greater degree of buffy coloration on the bars of the central rectrices. Immatures of *scolopaceus* are readily distinguishable by their grayer heads and by the narrower buffy edging to the feathers of the back and the tertials.

A striking amount of variation in degree of ventral spotting is exhibited by the series of small-billed specimens in which bars are absent on the breast and which are here referred to as *griseus*. Certain skins in adult summer plumage are entirely devoid of spots on the throat, breast and belly, although the spots are present to a limited extent on the sides. Others are heavily spotted over almost the entire ventral surface. No appreciable difference could be noted in the cinnamonic coloration of the ventral parts in comparable specimens of *scolopaceus* and *griseus* in summer plumage. There is, however, a marked change in this ventral coloration within both groups as the season progresses. With fading and wear a decided yellowish cast soon replaces the pinkish-cinnamon, resulting in a much more buffy color. In summer plumage, *griseus*, on the average, shows a greater amount of white on the posterior ventral surface than does *scolopaceus*.

It has generally been accepted as fact that the short-billed, eastern or inland form is more common on the Atlantic coast and in the mid-western states during the periods of migration than the long-billed western race which excels in numbers on the Pacific

coast. Critical examination of California-taken specimens in the Academy collection and comparison with breeding specimens from Alaska certainly failed to reveal a preponderance of the long-billed race in this state. The inland breeding form was found to exceed the western race by a ratio of approximately 5 to 1. When each specimen, including immatures, had been carefully identified on the basis of the known subspecific characters of the races, there were found to be 36 belonging to the form *scolopaceus* and 171 to *griseus*.

In regard to the specific distinction made by Rowan for the eastern and western dowitchers, it can be seen from the diagrams (fig. 18) that complete intergradation occurs with respect to bill length within each sex, although a much greater degree of dis-

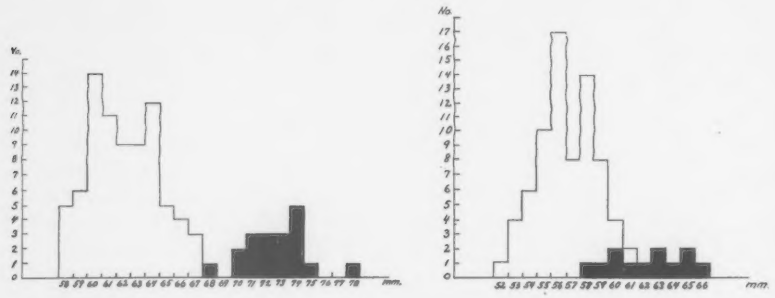


Fig. 18. Diagrams showing variation in length of culmen in dowitchers. Left, 97 females. Right, 81 males. All are California-taken specimens at least one year old. The white blocks represent the race *L. g. griseus*, the solid blocks, *scolopaceus*.

tinction occurs between the females of the two forms than between the males. The presence of bars on the sides of the breast in *scolopaceus* and their replacement by spots in the case of *griseus* may be taken as a fairly reliable subspecific character in summer-plumaged birds. Certain short-billed birds of the *griseus* type, however, show a slight tendency toward barring on the sides of the breast. Likewise, certain specimens representing *scolopaceus* show a definite reduction in these bars and a replacement in part by spots. This latter condition is well illustrated by a bird that presumably was breeding when taken on June 4, on the Yukon Delta, Alaska.

Regarding the validity of *hendersoni*, named by Rowan, there is considerable question. If it is a valid race, it unquestionably is close to *griseus*, differing from it in minor average characters. It would seem best, however, to consider it a synonym of *griseus*, as did Brodkorb, until such time as breeding birds are found within the supposed summer range postulated by Rowan for the eastern form.

No justification can be seen for Brodkorb's (*loc. cit.*) recent action in synonymizing *scolopaceus* and replacing it by the name *fasciatus*. Judging from that author's description, it is apparent that he has interpreted Say's description (*in* Long, Exped. Rocky Mts., I, 1823, p. 170) of *Limosa scolopacea* as applying to a spring bird assuming summer plumage. From Say's account, nevertheless, it would seem clear that his description is of a bird still in full winter plumage. Judging from a number of specimens of both races examined in such early spring plumage, his account would be equally applicable to either race. The bill length, however, indicates that Say was probably referring to a female of the western form. He gives 2¾ inches as the length of bill which is ap-

proximately 70 millimeters. This is far above the average for *griseus* and exceeds by 3 millimeters the extremes of any specimens of this race that I have measured. It is, furthermore, well within the range of variation in bill length for *scolopaceus*. It would seem most satisfactory, therefore, to accept Say's account as applying to the western form and consider *fasciatus* as a synonym.

No apparent difference was found to exist with respect to times of migration between the races *griseus* and *scolopaceus* in California. In the spring both races have been taken as early as March 9, and late northbound migrants of both have been taken in June (*griseus* on June 2, at Pt. Reyes, Marin County, no. 18743 in the Academy collection; *scolopaceus* on June 11, at Los Baños, Merced County, no. 933 in the collection of James Moffitt). Early southbound examples of *griseus* and *scolopaceus* have been taken on July 3 and 4, respectively. Late southbound migrants have been taken in October (*griseus*, October 29, and *scolopaceus*, October 12, both in Merced County). Small numbers of both races winter in California, principally in the southern part of the state. The most northerly winter-taken specimen examined is an example of *scolopaceus*, no. 669 in the collection of James Moffitt, taken on December 17, 1927, one mile west of Pierce, Suisun Marsh, Solano County, California.

In conclusion it may be said that both the Eastern Dowitcher (*Limnodromus griseus griseus*) and the Long-billed Dowitcher (*Limnodromus griseus scolopaceus*) occur in California in migration, but the former is very much more abundant than the latter. Based upon study skins in the Academy collection, *griseus* outnumbers *scolopaceus* in California by about 5 to 1. The characters segregating the two races are quite trenchant, although intergradation is evidenced by certain specimens. No differences in times of migration between the two races are apparent in California and limited numbers of both forms winter here, principally in the southern part of the state.

California Academy of Sciences, San Francisco, California, November 15, 1939.

FORAGING BEHAVIOR AND SURVIVAL IN THE SIERRA NEVADA ROSY FINCH

WITH FOUR ILLUSTRATIONS

By HOWARD TWINING

A tendency among naturalists today is to select for study animals which inhabit distant regions or those that are found only in inaccessible places. Remoteness adds appeal; the greatest treasures seem to exist in far off places. The author, realizing that some of the most common and accessible birds are often the least known, still yielded to this inclination, and selected as a subject for study the Rosy Finch (*Leucosticte tephrocotis dawsoni*) of the Sierra Nevada of California.

Virginia Canyon, where these observations were made, is situated in the northern part of Yosemite National Park. It is just west of the crest of the Sierra, about thirteen miles north of Tuolumne Meadows, four miles west of Green Lakes Lodge, and fifteen miles south of Bridgeport. A stream, Return Creek, runs through it, first southward and then westward to join the Tuolumne River about fifteen miles east of Hetch Hetchy Reservoir. The greater part of this study was confined to the region of a great cirque which forms the extreme upper end of Virginia Canyon. In this report the term "Virginia Canyon" refers only to the Hudsonian and Arctic-Alpine zones of the canyon, of which the major part is included in the great cirque.

The cirque is bordered on the east by Virginia Pass (10,600 feet) over which supplies were back-packed from our base at Green Lakes Lodge. The remoteness of the country and the difficulties of transportation were partly compensated for by the relief from human interference with the birds and their surroundings.

The east side of the canyon is a single steep slope covered with *Artemisia tridentata* and other plants which are representative of the Great Basin flora. The west side is more typically Arctic-Alpine. The slopes here are broken by rock outcrops, small sedge-covered meadows, occasional moraines, and small lakes. Timberline follows the lower edge of the cliffs. The trees are stunted white-bark pines (*Pinus albicaulis*), and are concentrated on the small ridges and other high spots on the floor of the cirque. During the early part of the year these stand out like islands surrounded by a sea of snow. The cirque contains several small lakes and one larger unnamed one, about two acres in extent, which we called "Leuco Lake." This lake is located on a shelf on the southwest side of the cirque.

Observations in Virginia Canyon extended from June 14 to July 31, 1936, and from June 14 to July 25, 1937. A reconnaissance of about thirty miles of the crest of the Sierra Nevada north of Virginia Canyon was made from May 23 to 31, 1936. Four days of the same year, between August 15 and 19, were spent in Virginia Canyon. In 1937 a ski trip into Virginia Canyon was made from May 16 to 18 to observe the activity of the birds early in the season. During the first two weeks of January of both 1935 and 1937, I searched for birds on the mountains surrounding Echo Lake (7500 feet) in Eldorado County, but was unsuccessful. Two short trips in late fall were taken into the high country east of Yosemite to observe the habits of the birds at that season.

My brother, Wilbur Twining, was my constant companion throughout the two periods of summer observations. Without his assistance this study would have been much more difficult, perhaps impossible.

The rosy finch is an opportunist, living throughout the year on whatever happens to be the most abundant and readily obtainable kind of food. The food supply varies with the season and locality, and an analysis of rosy finch food habits must take these matters into consideration.

Fig. 19. Virginia Canyon, Yosemite National Park, California, showing "Leuco Lake"; July 3, 1936. Receding snow banks at this season continually uncover new supplies of food for rosy finches.

Fig. 20. Head of Virginia Canyon, showing condition of snow and ice on June 21, 1937.

Grinnell and Storer (1924, Animal Life in the Yosemite, p. 432) report that the contents of crops of ten rosy finches collected in August consisted ninety-one per cent of small seeds and nine per cent of insects. This proportion is what would be expected at this time of year when the most abundant food is the ripening seeds of sedges and other low alpine plants. Earlier in the year, when there are still extensive surfaces of insect-covered snow, and when insects are hatching in trees and on lake shores, a larger proportion of insects probably is obtained.

During the early part of the nesting season when snow covers most of the food at higher altitudes, rosy finches concentrate either at comparatively low altitudes on patches of bare ground just above the dense stands of lodgepole pine, or at very high altitudes where winds, snow-slides and rapid melting have cleared the snow from the ridges and cliffs. Between the forest border and the mountain tops scattered birds may be found foraging, either on the rocky promontories which are first to clear of snow, or on the surface of the snow.

During May and early June there seem to be many more insects on the snow than there are later in the season. Smooth unbroken stretches of snow on the north-facing slopes are littered with dead insects, often numbering as many as twenty-five or thirty to the square yard. Despite this bountiful supply the rosy finch is usually found gleaning last year's sedge seeds on the open ground.

Many of the insects on the snow surfaces are not indigenous to the immediate region, but have been swept up to high altitudes by strong westerly air currents and dropped on the snow to become paralyzed, and eventually killed and preserved by the cold.

Rosy finches foraging on the snow usually advance into the wind. They obviously make selection from the variety of insects spread before them. On July 11, 1936, a bird was watched that took on the average one from the snow surface in every three or four feet, even though there were about two insects to the square foot. Small soft-bodied forms, especially dipterans, seemed to be preferred. Lady-bird beetles, although numerous, were never eaten, but small beetle elytra were often found in droppings. Lepidopterans and hymenopterans also seemed to be disregarded.

When snow is rapidly clearing from the timberline area, rosy finches congregate along the thawing edges of snow patches where food that has not been exposed since the previous fall is being uncovered. In the middle of June, the distance that certain snow patches receded in a day was found to vary from one foot to as much as thirty feet. The newly exposed areas expand much more rapidly than the food from them can be utilized by the rosy finches. Why, then, do the birds prefer to forage within a few inches of the edge of the snow, when there are great expanses of meadowland which have not been touched or have been gone over only superficially? This strip always insures a fresh supply of seeds which cannot have been extensively worked over. Perhaps for this reason the birds forage in the area of recognized abundance and disregard the rest.

There are, however, certain differences in the freshly uncovered food at the edge of the snow and the food that has been uncovered for some period of time. Seeds at the edge of the snow have been moistened by the melting snow and may be more palatable for that reason. Rosy finches that forage away from the edge of the snow usually are found on moist ground where they feed on damp seeds. Also, sedge seeds begin to sprout when still covered with many inches of snow, and when the snow melts they may have roots that already are several millimeters long. A day or more after the snow has receded most seeds have become so firmly rooted in the soil that they cannot easily be extracted. In order to find seeds with sprouts that are short enough so that the morsel is of manageable size, the birds must forage along the areas that are recently exposed.

Sedge seeds are usually worked in the bill momentarily before swallowing. The chaffy seed coat is separated and dropped, but usually some of it adheres to the sides of the bill, and this is occasionally wiped off on bristly sedge tufts.

Seeds of plants other than the sedge are eaten. A bird was observed eating seeds from the dried stalk of a cinquefoil (*Potentilla glandulosa*); another fed for ten minutes exclusively on the sprouting seeds of *Eriogonum ovalifolium*. A female industriously digging into soft earth was found to be feeding on the bulb of a young *Lewisia*. Another fed for three minutes on the tender young shoots of this plant.

The seed of the common *Erigeron compositus*, which is only found at very high altitudes, offers a readily obtainable supply of food for incubating female rosy finches that may leave the nest only for a few minutes. Uncovered by avalanches or winds, the seeds of this plant undoubtedly become an important part of the winter food supply.

As the season progresses, the supply of insects on the snow is reduced, for it is now late summer in the great valley to the west whence many of them came. The insect diet is maintained by indigenous insects which are hatching in abundance at this time. July 3, of both 1936 and 1937, was the earliest date on which I saw rosy finches foraging in white-bark pines. Here they were gathering a minute white scale insect (*Chionaspis pinifoliae*) from the bases of the needle clumps. Occasionally one would be seen picking insects from under the bark scales of these trees.

Sometimes rosy finches were seen picking small gnats from the foliage of sedges. They also pulled out large cutworms from the bases of sedge clumps. Before swallowing these they pressed out and discarded the intestines, which were filled with compact green masses of bits of sedge blades.

On July 5, 1936, rosy finches first gathered at the shore of Leuco Lake to feed on caddis flies. On that day the last bits of floating ice cleared from the lake. The caddis flies collected on the lower sides of rocks that overhung the water's edge, and the birds, by elaborate maneuvering, managed to pick off a few of them. Most of these insects, however, were captured in the air as they flew out over the lake.

The most active foraging began when mayflies first emerged in numbers. Along the lake shore, birds were seen catching these insects in flight, swallow style. They captured them at the water's edge, ouzel style, and in the meadows, pipit style. Nearby, rosy finches fed at the edge of the snow and on the surface of the snow.

The predominant method of feeding changes as the day progresses. In the early morning mayflies emerge, remaining for a while on the rocks, or on the water supported by the surface tension. During this morning period most captures are made by birds standing on half-submerged rocks, where they pick the insects that are being blown toward the shore from the surface of the water. Some of the more active birds fly over the water and gracefully pick the mayflies by the wings from its surface. This is a common method of feeding when there is no wind, and mayflies are resting motionless on the surface of the water, wings held vertically.

When the sun is high and the air has become warm, the insects start rising from the surface of the water and from crevices between partly submerged rocks. Rosy finches quickly gather around these centers of insect activity. Most of the captures are then made in the air. A mayfly seldom was seen to rise higher than twenty or thirty feet before it was caught, but occasionally a rosy finch would have to spiral upward for a hundred feet or more to make a capture. When mayflies are rising in numbers, a bird will sometimes make six or seven captures in one erratic flight far out and high over the lake. The captures in the air always involve a direct flight toward the insect and an upward swoop as the capture is made.

A mayfly is usually brought back to the rocks of the shore, where it is manipulated in the bill until both wings, and occasionally the cerci, are snipped off. The rest of the insect is swallowed. On long flights the insect is swallowed before the bird returns.

When a light breeze is blowing across the lake, masses of drowned insects float to the shore. In the shallow water near the shore, rosy finches work through this accumulation and pick out the palatable insects. Mayflies are preferred, and if these are drowned and water-soaked they are eaten wings and all. Small soft-bodied insects, such as gnats and mosquitoes, are also eaten. Rosy finches were observed foraging in a manner similar to this typical lake-shore method from the rocks and banks of a slow-moving stream

Fig. 21. Sierra Nevada Rosy Finch on shore of "Leuco Lake," showing throat bulging with food.

near McCabe Lakes. Here they were obviously competing with rainbow trout, for the fish of the stream were feeding on the same sorts of insects as were the birds.

Rosy finches were seldom seen drinking. Occasionally one did drink from Leuco Lake in a typical passerine fashion. One bird drank several times from water which was covered with a yellow scum of pollen from the white-bark pine. This pollen is a strong cathartic; a small amount will make a human being violently ill.

During the feeding at the lake shore, rosy finches seemed to alternate regularly between the lake shore and the edges of near-by snow patches. There is evidently a desire to include at least a small amount of vegetable matter with the insect diet that the birds get at the lake.

Occasionally a bird with bulging throat would fly from the lake shore diagonally up the slope toward the nesting cliffs. Several times I watched an individual alight near the shore of the lake and wipe a fecal sac from its bill onto a rock. Examination of these sacs disclosed a predominance of hard parts of insects, and some husks of seeds.

Between 10:30 and 11:00 a.m., the number of mayflies rising from the lake diminishes, and by noon of each day these insects practically disappear. Rosy finches would leave the lake during this period, and in the afternoon only occasional vagrant birds would be found there. On July 21, 1936, this exodus took the form of an organized flight from the lake. At 10:30 a.m. three birds arose from the lake shore uttering the *peuw* call. As this group circled over the lake, it received additions from all parts of the lake shore. After circling four times at a height of about a hundred feet, the flock, now numbering close to twenty individuals, flew far out over the valley, then turned and headed up the valley. During the afternoon, after the flight from the lake, rosy finches were exceedingly hard to find. They seemed to have split into small groups that were widely scattered over the valley.

Toward the end of the breeding season, rosy finches became numerous on the artemisia-covered, west-facing slope of Virginia Canyon. On July 13, 1936, a flock of about seventy-five rosy finches was observed on the slope north of Shepherd Crest. They were capturing minute insects from the foliage of the artemisia. They gathered these while standing on the ground, or while perching unsteadily on the tops of the flattened bushes. Occasionally a bird on top of a bush lost its balance and temporarily supported its body with its wings until it could regain its footing.

The main food of the rosy finch after the middle of July is the ripening seeds of the hair sedge. Most birds were found during this time in the small mountain meadows picking these seeds directly from the clusters at the ends of upright stalks. Rosy finches deserted the lake completely by the first week of August when the supply of mayflies was exhausted.

Rosy finches retain the flocking habit throughout the year. In the nonbreeding season they are at their numerical peak. During the nesting season the birds continue to assemble on the feeding grounds, but the groups then are noticeably smaller. In Virginia Canyon on July 27, 1936, I saw a flock of 200 adults, and on August 17, 1936, a flock of about 50 young and adults. On September 28 near Cathedral Peak I found a flock of about 35. On October 10, 1937, I saw 200 or more on the steep north face of Mount Clarke. A few flocks observed after the nesting season were small, but the large-sized flocks are, I believe, most characteristic of fall and winter.

Flocks in the breeding season are ephemeral groups, constantly fluctuating in numbers of birds, and continually breaking up and reforming. A twittering *whit-whit* usually is uttered continually by a few members of the flock and may serve to keep the birds together. A nasal *tee* or *peuw* is given when a flock flies and seems to serve as a sort of rallying call. When this call is given by members of a flying flock, lone birds often will stop foraging, utter the same note, and either resume foraging or fly to join the flock. A bird when alone appears to be more wary than when it is one of a flock, although there seem to be certain birds in every flock which are more sensitive to danger than others, or that act as sentinels to warn the flock of the approach of an intruder.

When several birds forage successively along the edge of a snow patch, the last bird seems to find just as much food as the first. Rosy finches never seem to exhaust the supply of food before moving on. Frequent flights for no obvious reason are characteristic of rosy finch behavior. Is this necessary in the economy of existence? Perhaps rosy finches must move this frequently in the winter months when food is scarce and cannot adjust themselves to fewer movements in the few months when food is more plentiful. Otherwise this must be attributed to an "outlet for excess of vigor," a supposition all too frequently used to cover ignorance of the meaning of bird action.

Despite the abundant food supply of the summer months, two foraging birds often quarrel when they approach each other. On June 21, 1936, in the snow-filled cirque west of "the pinnacles," this distance between birds was five to ten feet. In the course of normal foraging on damp ground at the edge of the snow the distance was usually about a foot. Pursuits occur regardless of sex, but the males seem the more irritable.

If a bird finds an especially good feeding ground, it may defend it against intrusion. A male feeding around a hole in the ice of a lake once routed three other birds that attempted to alight nearby; but it left after feeding for only about four minutes, even though succeeding birds seemed to find plenty of food there. On other occasions the defender may be routed. One male, that foraged with four other males, seemed to have found a good spot in a damp patch near the edge of the snow whereupon one of the others flew straight toward him. He lowered his head and flattened his body, but flew just as the other bird seemed about to strike. About ten seconds later a third bird usurped the same area without meeting resistance.

Occasionally two males engage in short pursuits for no obvious reason. On June 30, 1937, I was observing two males foraging near a waterfall just below Leuco Lake. One pursued the other from grass to rock to snow, back and forth for seven or eight flights. Then the pursued became the pursuer and the flights continued. The flights were obviously not hurried, and at no time did either bird *ever* strike the other. Occasionally, when both birds alighted on the same rock, one would run head down across the rock, driving the other off. Once, a pursuit ended abruptly after three minutes and the two then fed in perfect harmony, often within a foot of each other. Five minutes later the pursuits were continued and lasted two minutes more before the birds again resumed feeding.

The Sierra Junco (*Junco oreganus thurberi*) is probably the bird most commonly associated with the Sierra Nevada Rosy Finch. Juncos have been observed foraging along the edges of receding snowbanks early in the season at a time when rosy finches depend almost entirely on these border areas for their food supply.

On July 21, 1936, a male rosy finch was catching mayflies in the air above the north shore of Leuco Lake. A junco in juvenal plumage was performing almost identical actions. The two would leave the rocks at about the same time and head for the same insect. As the rosy finch caught the insect, the junco would feint at it, then both would return to the rocks. This performance continued for about half an hour before the rosy finch left for the opposite side of the lake. It may be that the young juncos learn this method of catching insects from the rosy finches. On other occasions I saw flocks of young juncos mixed with rosy finches on the lake shore, catching insects in a similar way.

White-crowned Sparrows are found in the same area as rosy finches, but their forage ground is in or near the clumps of dwarf willow where rosy finches seldom feed. A pair of Water Ouzels fed regularly along the lake shore. With the bill or the entire head submerged they captured small insects just below the surface of the water. Rosy finches seemed to overlook or ignore this underwater food, for a Water Ouzel often would feed for a minute or two along the edge of a small rock where several rosy finches had passed a short time before without making a capture.

As the snow melts in June and July, much food is uncovered at high altitudes. Many species of birds move up from lower altitudes to take advantage of this abundance, and they stay while insects hatch and seeds of plants mature. While these birds are present there, the food problem is not important; there is plenty for all, and especially for the rosy finches, for they can adapt themselves to several sources of supply, any one of which probably could sustain the entire rosy finch population.

In the winter when the food problem becomes a serious one, other birds migrate to lower levels. What happens to rosy finches in the winter months is still a puzzle. I have found only one record of rosy finches in the high Sierra in mid-winter. On January 8, 1935, Stewart Kimball saw a flock of fifteen foraging on the snow high on the west slope of Mount Lyell. I have received several reports of flocks seen in the desert country of Inyo and Mono counties east of the Sierra. It is possible that rosy finches move to lower levels only as a temporary retreat from winter storms.

A region that supports few birds would be expected to have few animals that prey on birds. This is true of Virginia Canyon. Occasionally a Sparrow Hawk approached the nesting cliffs and was pursued by one or several rosy finches until it left. One Goshawk and one Cooper Hawk were seen in our stay at Virginia Canyon. Late in the year a group of fifteen rosy finches was observed pursuing a Sharp-shinned Hawk as it circled over a flock of two hundred rosy finches on Mount Clarke. I have seen Prairie Falcons in other parts of the high country, but not in Virginia Canyon. Horned Owls were never seen or heard above timberline.

Rosy finches probably suffer desultory attacks from all of these birds, but I doubt if any of them is common enough to affect seriously the rosy finch population. Dixon (Condor, vol. 38, 1936, p. 4) considers the Clark Nutcracker the most important predator on rosy finches in the Mammoth Pass region of the Sierra Nevada. He has observed nutcrackers which seemed to be actually searching the cliffs for rosy finch nests. In Virginia Canyon, however, I saw no indication that the nutcracker was predatory on rosy finch eggs or young. The only nutcrackers I ever saw in the nesting area were merely passing by or had stopped to rest. I never saw one searching for a nest; but, they seem to be regarded as enemies, for occasionally a passing nutcracker would be pursued by one or several rosy finches.

Fig. 22. Pinnacles at head of Virginia Canyon in which rosy finches nested.

Of the smaller predatory mammals, weasels and chipmunks were the only kinds encountered. The least weasel was occasionally seen in the high meadows of the upper part of the valley, and the larger mountain weasel was seen once, near timberline. Weasels are doubtless a menace to ground-nesting birds, but I never saw them leave the meadows, where meadow mice, ground squirrels, and chipmunks are abundant, to forage on the relatively barren cliffs above.

The alpine chipmunk (*Eutamias alpinus*) was probably the most common mammal in the timberline area of Virginia Canyon. Circumstantial evidence marking this animal as a nest robber has been accumulating through two summers. By watching its unceasing activity it can be seen how few nests on the ground can escape its ultimate detection. I was never able to observe a chipmunk actually raiding a nest, but after watching many nests day after day, only to discover clutches of eggs suddenly missing or the young lying dead and half-eaten, I was forced to conclude that only the chipmunk could be responsible for such widespread damage.

White-crowned Sparrows evidently suffered heavily from chipmunk attacks in Virginia Canyon. In 1936 I found five nests of the White-crowned Sparrow, all located on the ground near timberline. Two of these were robbed of eggs; the other three, at some stage of development, were found with badly mangled and partly eaten young.

Chipmunks are found commonly on the barren rocks and cliffs from timberline to the tops of the mountains and here they are good but cautious climbers. The rosy finch usually protects its nest from climbing animals by building it in a niche surrounded by smooth rock or by placing it below an overhang. In 1936 eleven nests, all on cliffs, were well protected and none was destroyed. In 1937, of ten nests on the cliffs, two were in sites that were obviously accessible to climbing mammals and both were raided. One of these was protected from below by a wall of snow, but the very day the snow melted sufficiently to allow a chipmunk room to squeeze around it, the four young were carried off. One of these was found badly mangled among the rocks below the nest. Indisputable evidence of the chipmunk's presence at the nest that day was found in the form of chipmunk excreta in the cup of the nest.

The three nests found in moraines in Virginia Canyon were situated high on mountain slopes far from vegetation. The danger of discovery by prowling mammals was thus reduced to a minimum. In spite of this precaution, two of these nests were robbed of their eggs.

Other regions may have different animals that are important predators on rosy finches, but in Virginia Canyon it appears that predation by the chipmunk not only tends to limit breeding rosy finches to the vicinity of the highest cliffs, but also it is the most important factor in the mortality rate of eggs and nestlings.

Oakland, California, November 10, 1939.

SOME OBSERVATIONS ON HORNED OWL NESTS

By HENRY S. FITCH

In the spring of 1939, several nests of the Horned Owl (*Bubo virginianus*) were observed by the writer on the San Joaquin Experimental Range, Madera County, California. This locality, in the low rolling foothills of the Sierra Nevada, is sparsely wooded with digger pine, blue oak, and interior live oak. Over most of the area rodents are not subjected to control by man, and their abundance probably constitutes a circumstance favorable to the occurrence of horned owls.

In October, 1938, a horned owl census was attempted. On an area of 1920 acres, 20 owls (6.6 per square mile) were counted as their presence was revealed by their hooting to observers walking along parallel courses one-quarter of a mile apart; the time and approximate location of each owl heard was recorded. It seemed probable that the owl population exceeded the number heard hooting, as several were seen which did not call during the time the count was being made. On April 4, 1939, a count of 25 was obtained on this same area, and on November 27, 1939, 24 were counted.

Varied types of nesting sites were chosen by the several pairs of owls observed. One was the hollow in the dead and enlarged portion of the trunk at the top of a growing blue oak. No nesting material had been gathered; the eggs were lying in a slight depression in the loose mass of dry woodrat feces which had accumulated there. One side of the hollow trunk had rotted away down to the level of the nest floor, so that an owl could be seen from the ground as it sat on the nest.

Another nest was a large mass of heavy sticks, possibly gathered in part by the owls themselves. It was in an extremely exposed and conspicuous situation in the crotch of a broken-off pine snag, about 25 feet above the ground. Three other occupied nests were high in live pine trees; each was in a crotch against the main trunk. These nests were loose platforms of twigs. A sixth nest was in a live oak in the close-set twiggy branches near the peripheral foliage, which effectively sheltered it from above. This latter nest originally may have been that of a woodrat which later had been appropriated by the owls.

A nest found on March 28, 1938, on a large horizontal branch of a pine, about ten feet out from the main trunk, in an exposed situation, contained half-grown young. A pair of owls had been observed using this same nesting site in 1937.

In 1939, the first nest was found on March 7, and it then contained two eggs. On March 30, the young were newly hatched. On each of the next two nights, prey was brought by the parents and the young grew noticeably. On the morning of April 2, both young were dead, evidently as the result of a sudden cold rain during the night, which had soaked and chilled them while the mother was away from the nest. On the night of April 4, one of the parent birds was heard hooting and clucking at a point near the nest tree. On April 6, it was found that new items of prey had been brought to the nest since the death of the young. In another nest, on March 8, the female was incubating two eggs. On March 25, the young had hatched and prey was lying beside them. Six visits were made by the observer while the young were in this nest, and on three of these occasions there was fresh prey. On April 16, the young appeared to be nearly ready to leave the nest.

A nest first investigated on April 1, had two eggs on that date. On April 16, the young had hatched and appeared to be several days old. On April 20, one young had disappeared and no trace of it could be found. Evidently it had been taken by some predator. On April 29, the other half-grown young had likewise disappeared and the

nest seemed to be deserted. While no clue as to the identity of the nest robber was left in either instance, the red-tailed hawk seemed the most probable culprit among the bird and mammal predators occurring locally.

Another nest already contained half-grown young on April 14, when it was found. Judged by their behavior, these young were nearly ready to leave the nest on May 5; they were not found there on subsequent visits. During the three week period elapsing between the discovery of the nest and the leaving of the young, the nest was visited on each of thirteen days, and on ten of these occasions it was found to contain prey totalling 19 items.

An adult owl was discovered sitting on another nest on March 8. On March 23, an observer climbed nearly to the nest before the adult flushed. Two eggs were still unhatched. On April 8, the female owl flushed from the nest when the observer had approached within twenty feet. It perched in a nearby tree. The male owl then appeared in another tree and the two gave low hoots at short intervals, answering each other; the male also snapped his bill. Both parents flew by the observer, passing within a few feet, and then perched only a few yards away, still snapping their bills and hooting. There were young in the nest, and they appeared to be at least a week old. They showed signs of distress when exposed to the sunlight after the mother flushed, and as she lit on the edge of the nest in returning, they crowded against her breast seeking shelter from the intense rays of sunlight. At the next visit, on April 12, the observer found the young were visible from the ground, and they seemed to stand high in the nest. The reason for this became apparent when the observer climbed to the edge of the nest; the bowl was filled with a pile of dead animals, in various stages of decomposition, all brought by the parents since the observer's previous visit four days before. They filled the nest bowl up to its rim with a soggy mass of decaying flesh. Swarms of flies were buzzing about. Large maggots partly filled the decomposing bodies and also carpeted the bottom of the nest; many had entangled themselves in the downy plumage of the nestlings. The nest contained remains of 16 mammals, including 10 woodrats (all adults), 3 adult kangaroo rats, 2 young cottontails, and 1 young ground squirrel. On April 13, both young owls were dead, evidently as a result of the unsanitary conditions created by the mass of decaying flesh in the nest. Ear infections present in both young owls, evidently had been caused by entry of maggots into the ear orifices.

Thus, of the five nests observed, three were failures from a different cause in each instance, namely, weather, predator, and unsanitary conditions created by uneaten prey. From the different nests a total of 67 prey items were recorded, distributed as follows: no. 1, 8 kangaroo rats, 1 cottontail; no. 2, 10 woodrats, 4 kangaroo rats, 3 cottontails, 3 ground squirrels, 1 gopher; no. 3, 4 woodrats, 2 kangaroo rats, 2 ground squirrels, 1 cottontail; no. 4, 4 cottontails, 3 ground squirrels, 1 kangaroo rat, 1 gopher; no. 5, 9 woodrats, 4 cottontails, 3 ground squirrels, 2 kangaroo rats, 1 gopher. Rodents and rabbits comprised all of the 67 items: 23 (34 per cent) were woodrats (nearly all of them adults), 17 (25 per cent) were kangaroo rats, 13 (19 per cent) were cottontails, 11 (16 per cent) were ground squirrels, 3 (5 per cent) were pocket gophers. Of these species, gophers were by far the most abundant on the areas where the nests were situated; kangaroo rats were also abundant; ground squirrels were considerably less numerous than either, with an average population of perhaps 2 or 3 per acre. Cottontails and woodrats were much less numerous than any of the other species, and their predominance among the prey items indicates definite selection on the part of the owls. It was noteworthy that in the course of these observations, no birds of any kind were brought to the nests by the owls. Quail were moderately abundant on the area with a population

estimated at about one per acre (Glading, Calif. Fish and Game, vol. 24, 1938, p. 319), but apparently these and other species of birds do not constitute an important part of the owls' diet in this area during the spring months. The absence of smaller rodent species among the recorded prey is also noteworthy. Three species of *Peromyscus* (*maniculatus, boylii, truei*) were all common, and two species of *Perognathus* (*californicus* and *inornatus*) also occur on the area. It seems likely that rodents of rat or squirrel size are a type of prey most easily obtained by the owls, and perhaps preferred by them. On the Experimental Range, where such prey was present in abundance, birds, smaller rodents and reptiles, although also abundant, seemed to be little used. The presence of several ground squirrels among the items recorded furnished evidence that diurnal foraging is a fairly common habit with these owls.

U. S. Biological Survey, Berkeley, California, November 20, 1939.

EFFECTS OF NATURAL ABRASION AND OXIDATION ON THE COLORATION OF FLICKERS

By FREDERICK H. TEST

In the course of a recent study of flickers (*Colaptes*) I have found it desirable to investigate, somewhat more fully than is usually done, changes that occur in the color of the plumage between molts. This matter of "wear" has been mentioned or discussed by many authors, for students of avian systematics find that consideration of it is necessary in most of their studies of variation in color.

It is now well established that a feather once mature is dead and cannot be affected thereafter by the bird's physiology. As only those features of coloration that relate to the physiology of the bird are of use in systematics and certain other studies of variation, workers should be alert to recognize and rule out of consideration changes that are direct results of external factors. But this is often a difficult thing to do accurately. The usual method employed by systematists is comparison of birds showing approximately equal degrees of "wear" in the plumage. In a large proportion of cases, individuals taken at about the same time of year are satisfactory for comparison, though differences in such factors as breeding season and habitat sometimes necessitate special caution.

Thus, in a general way, considerable attention has been paid to seasonal differences in coloration resulting from external influences. It has been shown that the loss of parts of feathers sometimes decidedly alters the coloration and color pattern of a bird's plumage. In addition to the observed loss of structure, changes in color have been thought to result from "fading" of the pigment that remains.

It was my object to determine by experiment, as well as by examination of museum skins, the relative importance of abrasion and sunlight in effecting changes in the coloration of the plumage of flickers. Furthermore, I wished to test their differential effects on the several colors and pigments present in the feathers. From information on this matter, one should be able to predict the way in which coloration of many other kinds of birds would be altered by any similar set of conditions.

In other studies, as yet unpublished, I have shown that the colors of flickers are produced by two classes of pigments, melanins and carotenoids. These two types differ considerably in their chemical composition, physical condition, distribution in feather parts, physiologic relations in the bird, and manner of deposition. The melanin pigments produce the black and brown colors and may be present in any or all of the three principal kinds of structures of a feather, the shaft, rami, and barbules. The bright reds and yellows of flickers result from carotenoid pigments. They may occur in the shaft and rami but apparently are absent from the barbules. Sometimes both carotenoids and melanins are found in the same part of a feather.

For the experiments on abrasion and fading, feathers were plucked from museum skins collected within the previous twenty-seven months and kept in darkness almost continually since that time. Two feathers of each kind were taken, from adjacent follicles when possible, and these were carefully compared for detection of possible slight differences in coloration. One feather of each sample was put in an envelope, which was laid away in a light-proof specimen case kept at room temperature. The other feather of each kind was fastened with one or two small strips of transparent adhesive tape to a gray, cellophane-covered cardboard, which was then taped on the outside of a south-facing windowpane at Berkeley, California; in this situation the feathers received sunlight most of the day. The flight feathers were fastened with their under surfaces out-

ward, and all feathers were entirely exposed to the action of air, sunlight, rain, and wind, except for a small part of the vane of each rectrix, which was covered by the head of a thumb-tack. Abrasion was impossible because each feather was securely taped to the cellophane that covered the cardboard; abrasion from rain is considered to be negligible. The feathers were exposed in this manner from September 30, 1938, until November 3, and from December 8 until February 8, 1939. A record of the feathers tested, and the results of examination of them on February 8 are given below. Unless otherwise indicated, the feathers were typical of the species. Names of colors with initial capitals are taken from Ridgway (Color Standards and Color Nomenclature, 1912), and the descriptions apply only to the pennaceous surfaces exposed in this study, unless specifically stated otherwise.

Colaptes cafer (original no. 411, F.H.T.), adult male, October 17, 1936, Walnut Creek, Contra Costa County, California:

Rectrix.—Control feather, between Scarlet and Grenadine Red, except for black distal end. Experimental, Strawberry Pink, much paler than control, except part of vane covered by thumb-tack, which is same color as control; black tip almost imperceptibly browner.
Primary.—Control, between Grenadine Red and Bittersweet Orange. Experimental, considerably paler than Shrimp Pink.
Interscapular.—Control, black bars alternating with broader interspaces of a hue between Wood Brown and Drab; shaft and rami pink. Experimental, brown regions slightly paler than control, barbules appearing slightly more brownish, less blackish; black regions apparently unchanged; carotenoid color of shaft and rami much paler.
Breast.—Control, dusky Pale Salmon Color with black subterminal spot. Experimental, melanic pigmentation of pennulae (slender distal parts of barbules) and of black region unchanged; carotenoid color much paler.
Throat.—Control, Pale Neutral Gray (mass effect on throat of bird) resulting from colorless rami and bases of barbules in combination with black pennulae. Experimental, pigmentation of pennulae slightly browner.
Crown.—Control, between Brussels Brown and Drab. Experimental, black melanin of pennulae and brown melanin of rami unchanged in color; shaft and rami paler and browner, apparently because of much paler carotenoid color.
Malar.—Control, rami in distal part of feather swollen, without barbules, and Spectrum Red in color; middle region of feather buffy. Experimental, red rami unchanged in color; pennulae or buffy region paler brown; black melanin in downy pennulae unchanged.

Colaptes auratus (feathers from several specimens):

Rectrix.—Control, Light Cadmium, with black tip. Experimental, lost; examination shortly before experiment ended showed it much paler than control.
Interscapular.—Control, similar to that of *cafer*, but carotenoid color yellow instead of pink. Experimental, changed as in *cafer*.
Breast.—Control, mostly a hue near Light Pinkish Cinnamon, but browner and more dusky; subterminal black spot; tip nearly white; rami and shaft yellow. Experimental, brown pigment slightly paler than in control; black region unchanged; carotenoid color almost lacking.
Throat.—Control, Light Pinkish Cinnamon. Experimental, unchanged.
Malar.—Control, black. Experimental, mostly unchanged, but extreme proximal part of pennaceous region considerably browner than in control.
Nuchal crescent.—Control, rami of terminal part swollen, without barbules, and Spectrum Red; proximal pennaceous part gray. Experimental, red rami unchanged; black melanin of gray region slightly browner.

A pink secondary taken from *Colaptes cafer* (original no. 679, F.H.T.), adult female, March 13, 1938, Davis, Yolo County, California: Control, between Orange-Pink and Grenadine Pink. Experimental, vane almost colorless; shaft paler than Orange-Pink.

An orange rectrix from atypical *Colaptes cafer* (no. 69417, Mus. Vert. Zool.), adult male, June 29, 1936, Rapid City, Pennington County, South Dakota: Control, Salmon-Orange. Experimental, between Bitterweet Pink and Safrano Pink.

Summarizing the results of this experiment, we find that the carotenoid colors of the flight feathers became much paler during their exposure. Examination of the feathers at intervals showed this change to be progressive. The yellow and the red flight feathers differed in that the yellow ones became paler but did not change otherwise. The red feathers became less yellowish as they paled, as did also the orange feather. It will thus be seen that Deakin's hypothesis (Amer. Nat., vol. 70, 1936, p. 587) that the orange hue found in certain flickers might result from fading of yellow pigment in heterozygous birds probably is not correct. In contrast to the reaction of the carotenoid pigments in the flight feathers, the red pigments of the malar feathers of *cafer* and the nuchal crescent feathers of *auratus* showed no observable change in color or tone, either when viewed with the naked eye or when examined with the 16 mm. objective of a compound microscope.

Of the melanic colors, the blacks (as in the malar feathers of *auratus*, the subterminal spots of the feathers of the breast, and the bars of the interscapulars) showed either no change or one that was scarcely perceptible. Most of the grays and browns became slightly paler, and the former turned more brownish.

These changes in both kinds of pigments probably resulted from oxidation, for abrasion was negligible in the experiment. The role of light in the oxidation of the melanins seems to be small. In contrast, there is evidence that light is important as a catalyst in the oxidation of the carotenoids in the feathers. This evidence is the difference in color between parts of the experimental feathers. The morphologically lower sides of the flight feathers exposed to the action of both light and oxygen became pale, as described above. In contrast, the parts of the vanes covered by the heads of thumbtacks, and the upper sides of the shafts, which were facing the cardboard, remained practically unchanged. As these parts were exposed to oxygen but scarcely, if at all, to light, it seems reasonable to conclude that light was the critical factor in the paling of the other parts of the feathers. The keratin in which the carotenoid pigments lie probably protects them from much contact with oxygen. Some air may be present in small intercellular spaces in the feather, and minute amounts perhaps reach the pigments through the keratin or through pores in it, but not enough is known of the morphology of these feathers to decide which suggestion is more probable. It is known, however, that carotenoids are very susceptible to autoxidation in air, even at room temperatures, and that light greatly facilitates this process (Bogert, *in* Gilman's "Organic Chemistry," vol. 2, 1938, p. 1183). That the carotenoid pigments in the feather are partly protected in some way, as by the keratin filtering out certain light rays or preventing contact with oxygen, seems highly probable; irradiation with ultra-violet, according to Bogert, has been found to destroy unprotected carotene (a carotenoid pigment) in three hours. The purity of the pigments in the feather and their physical state may also be important factors in their resistance to change of color.

At present I am unable to explain the lack of change in the red color of the malar and nuchal crescent feathers. The structure of the carotenoid-containing parts of these feathers may be such as completely to prevent contact of the pigments with oxygen. The decrease in yellowness of the flight feathers of *cafer*, when they are exposed to light, may be explained in one of two ways on the basis of the fact that both red and yellow pigments are present in the newly grown feather (unpublished data). Either (1) the yellow pigments oxidize more rapidly, or (2) the yellows, being present in smaller amounts, become completely oxidized (rendered colorless) before the reds do. Perhaps both factors contribute to the result, but because the experimental orange rectrix, which contained much less red than yellow pigment, also became slightly redder, differential rate of oxidation is the more probable explanation.

It should be profitable to compare the results obtained in the experimental exposure of feathers with the colors found in the plumage of a wild-taken, breeding bird, for this should provide some idea of the importance of abrasion in producing changes of color in free-living birds. In making such a comparison I have used a male *C. cafer collaris* (no. 69437, Mus. Vert. Zool.) taken July 16, 1936, at an altitude of 5300 feet on Twelve-mile Creek, Washoe County, Nevada. This bird probably had recently finished caring for its young, and its plumage shows a large amount of change due to exposure. The locality where it was taken is one with intense sunlight.

The black regions of the feathers of this specimen seem nearly unchanged in color. Microscopic examination shows scarcely any effect of abrasion, which would be evidenced by loss of barbules or by wearing of the rami and shaft; the color of the feather parts appears just as dark as in the experimental feathers and in feathers from fresh-plumaged birds.

In contrast to this condition, the brown and gray regions of the feathers appear considerably paler to the naked eye than do those of both the experimental and the control feathers; the tips are most strongly affected. An indication of the change in color that has occurred is afforded by comparing the distal brown region of five recently grown interscapulars with the same parts of nearby feathers that had been regenerated by the bird in the molt of the previous autumn. The newer feathers are Tawny-Olive, the old ones slightly browner than Vinaceous-Buff. On microscopic examination, these changes are seen to result principally from two things: (1) a loss of barbules, leaving considerable sections of rami bare and exposing the almost colorless bases of barbules and the sides of the rami; and (2) wearing away of the melanized upper surfaces of the rami, exposing the unpigmented parts beneath. The pigment in the barbules appears only a little paler in color than does that in barbules of unworn feathers. This indicates that oxidation of pigment plays relatively little part in the changes of melanic colors in the flickers, although it probably is facilitated by the exposure of melanin to the air in the wearing away of keratin.

In addition to the causes of paling just described, a paler "mass effect" in certain groups of feathers (those of the throat, for example) is achieved in part by exposure of the paler basal parts of feathers through loss of pigmented structures in the overlying ones. In other groups of feathers, particularly those of the wings and back, a differential loss of black and brown parts of the feathers results in a darker general effect. As other observers have noticed in certain other species, the black bars on the flight feathers are abraded much less rapidly than are the brown regions between them. It seems possible to me that the dense deposits of melanic pigment in the black rami and barbules serve to strengthen these parts to an extent such that they are less easily broken than are the much less heavily pigmented brown rami and barbules.

The red pigments of the malar regions and nuchal crescent of the Nevada bird, appear unchanged, although each malar region as a whole appears lighter in color because loss of the tips of the rami has partly exposed the pale buffy middle regions of the feathers. The effect on these feathers of several months exposure to sunlight is, thus, negative, as was true with the experimental feathers.

The red color of the outer rectrices, those most exposed to light, is considerably duller, paler, and less orange than that of the inner ones. Specifically, the colors are, respectively, between Scarlet and Peach Red but slightly redder than either, and a trifle redder than Grenadine Red. A corresponding difference exists between outer and inner primaries. The change in color of these rectrices and remiges is thus much less than that occurring in the experimental feathers, the difference between the two presumably

resulting from a difference in length of time of exposure to intense light. The differential between outer and inner feathers is further evidence of the importance of sunlight in the oxidation of the carotenoids.

The proximal part of the upper surface of the shaft of each proximal secondary exhibits a pattern of alternate sections of pale pink and more intense pink. I have seen this same coloration in other breeding flickers, particularly those from regions of strong and long-continued sunlight. The explanation seems to be that the black bars of each of several secondaries protect the pigment in the shaft of the feather beneath to a greater degree than do the less heavily pigmented, brown interspaces, for the pale pink sections always coincide with the brown regions, and the more intensely pink sections with the black regions, of the overlying feather. The basal parts of the shafts of the proximal secondaries are little altered in color, for they are protected by several coverts and scapulars. In this Nevada-taken specimen, the distal parts of the shafts of secondaries nine and ten, which parts probably are exposed to light most of the time, are nearly colorless.

The pinkish hue found in newly grown feathers of breast and back is almost absent from the feathers of the breeding Nevada specimen, their condition in this respect being like that produced in the experimental feathers.

SUMMARY

Experimental exposure to sunlight for sixty-five days of several kinds of feathers from flickers in fresh plumage resulted in a paling in their coloration. The carotenoid colors (reds and yellows) of all feathers except the red malars and nuchal crescent feathers were strongly affected; the latter type of red apparently was unaltered. The changes in color probably result from slow oxidation under the influence of sunlight. The melanic hues (browns, blacks, and grays) were only slightly affected by the exposure.

Comparison of these results with the conditions found in breeding birds shows that the changes that take place in the carotenoid colors of free-living individuals are similar to those seen in the experimental feathers; the amount of change varies in inverse proportion to the amount of protection from sunlight. The changes in the melanic hues are principally a result of loss of pigment through abrasion; black regions scarcely change, because loss of pigment is slight and that which does occur is rendered imperceptible by the great concentration of black.

Museum of Vertebrate Zoology, University of California, Berkeley, November 24, 1939.

BIRDS OF BRAZOS COUNTY, TEXAS

WITH ONE ILLUSTRATION

By WILLIAM B. DAVIS

Brazos County, situated in the southeastern part of Texas, is in what Cope (Bull. U. S. Nat. Mus., no. 17, 1880) termed the Eastern Texas Plain, a Tertiary lacustrine deposit. The bird fauna consists of eastern, southern, and western elements. Less than sixty miles to the south the fauna is distinctly that of the Gulf Coast, and approximately one hundred miles to the west, where the first abrupt rise in elevation is encountered (the so-called first plateau), the avian fauna contains a large number of distinctly western genera and species.

Topographically, the county varies from nearly flat to gently rolling, with elevations between 300 and 400 feet. The uplands support dense stands of post oaks and open prairies. The river bottoms consist of poorly drained lands and swamps, supporting heavy stands of water oak, pecans, hackberry, and other hydrophilous vegetation.

This report on the birds is based upon specimens in the Texas Cooperative Wildlife Collection at the Agricultural and Mechanical College of Texas, supplemented by the sight records and notes of Mrs. D. Scoates, T. D. Burleigh, Walter P. Taylor, Valgene Lehmann, Dan Lay, Bernard E. Ludeman, and myself. In instances where specimens have been available the name of the species is preceded by an asterisk. I am indebted to Dr. H. C. Oberholser for checking the identifications of all specimens and for many helpful suggestions.

RESIDENT SPECIES

Here are listed those species that are considered permanent residents in the county. Individual birds may move to and from the area seasonally, but the species, as such, are thought to be here the year round.

Ward Heron (*Ardea herodias wardi*)
Wood Duck (*Aix sponsa*)
*Western Turkey Vulture (*Cathartes aura teter*)
Black Vulture (*Coragyps atratus atratus*)
Cooper Hawk (*Accipiter cooperii*)
*Eastern Red-tailed Hawk (*Buteo jamaicensis borealis*)
*Florida Red-shouldered Hawk (*Buteo lineatus alleni*)
*Eastern Sparrow Hawk (*Falco sparverius sparverius*)
*Texas Bob-white (*Colinus virginianus texanus*)
*Purple Gallinule (*Ionornis martinica*)
Western Mourning Dove (*Zenaidura macroura marginella*)
Killdeer (*Oxyechus vociferus vociferus*)
Road-runner (*Geococcyx californianus*)
Barn Owl (*Tyto alba pratincola*)
Hasbrouck Screech Owl (*Otus asio hasbroucki*)
Great Horned Owl (*Bubo virginianus virginianus*)
*Florida Barred Owl (*Strix varia georgica*)
Southern Flicker (*Colaptes auratus auratus*)
*Red-bellied Woodpecker (*Centurus carolinus*)
Red-headed Woodpecker (*Melanerpes erythrocephalus*)
Southern Hairy Woodpecker (*Dryobates villosus audubonii*)
*Southern Downy Woodpecker (*Dryobates pubescens pubescens*)
*Blue Jay (*Cyanocitta cristata cyanotephra*)
Southern Crow (*Corvus brachyrhynchos paulus*)
*Plumbeous Chickadee (*Penthestes carolinensis agilis*)
*Tufted Titmouse (*Baeolophus bicolor*)
White-breasted Nuthatch (*Sitta carolinensis carolinensis*)
*Carolina Wren (*Thryothorus ludovicianus ludovicianus*)
*Eastern Mockingbird (*Mimus polyglottos polyglottos*)
*Southern Robin (*Turdus migratorius achrusterus*)

*Eastern Bluebird (*Sialia sialis sialis*)
*White-rumped Shrike (*Lanius ludovicianus excubitorides*)
*English Sparrow (*Passer domesticus domesticus*)
*Southern Meadowlark (*Sturnella magna argutula*)
Rio Grande Red-wing (*Agelaius phoeniceus megapotamus*)
*Bronzed Grackle (*Quiscalus quiscula aeneus*)
*Louisiana Cowbird (*Molothrus ater buphilus*)
*Big-billed Cardinal (*Richmondena cardinalis magnirostris*)
Western Grasshopper Sparrow (*Ammodramus savannarum*)
*Western Lark Sparrow (*Chondestes grammacus strigatus*)

WINTER VISITANTS

In this category are listed those species occurring in this vicinity only in fall, winter, and early spring. None of them is known to breed here.

Pied-billed Grebe (*Podilymbus podiceps podiceps*)
Florida Cormorant (*Phalacrocorax auritus floridanus*)
Common Mallard (*Anas platyrhynchos platyrhynchos*)
Baldpate (*Mareca americana*)
American Pintail (*Dafila acuta tzitzihoa*)
*Ring-necked Duck (*Nyroca collaris*)
Western Red-tailed Hawk (*Buteo jamaicensis calurus*)
Broad-winged Hawk (*Buteo platypterus platypterus*)
Sharp-shinned Hawk (*Accipiter velox velox*)
*American Coot (*Fulica americana americana*)
American Woodcock (*Philohela minor*)
*Wilson Snipe (*Capella delicata*)
Burrowing Owl (*Speotyto cunicularia hypugaea*)
Northern Flicker (*Colaptes auratus luteus*)
*Yellow-bellied Sapsucker (*Sphyrapicus varius varius*)
*Northern Yellow-bellied Sapsucker (*Sphyrapicus varius atrothorax*)
*Eastern Phoebe (*Sayornis phoebe*)
Prairie Horned Lark (*Otocoris alpestris praticola*)
Red-breasted Nuthatch (*Sitta canadensis*)
*Brown Creeper (*Certhia familiaris americana*)
*Western House Wren (*Troglodytes aëdon parkmanii*)
*Eastern Brown Thrasher (*Toxostoma rufum rufum*)
*Western Brown Thrasher (*Toxostoma rufum longicauda*)
*Eastern Robin (*Turdus migratorius migratorius*)
*Eastern Hermit Thrust (*Hylocichla guttata faxoni*)
*Eastern Golden-crowned Kinglet (*Regulus satrapa satrapa*)
*Eastern Ruby-crowned Kinglet (*Corthylio calendula calendula*)
American Pipit (*Anthus spinoletta rubescens*)
Sprague Pipit (*Anthus spraguei*)
*Cedar Waxwing (*Bombycilla cedrorum*)
*Migrant Shrike (*Lanius ludovicianus migrans*)
*Starling (*Sturnus vulgaris vulgaris*)
*Myrtle Warbler (*Dendroica coronata coronata*)
*Hoover Warbler (*Dendroica coronata hooveri*)
Eastern Meadowlark (*Sturnella magna magna*)
*Western Meadowlark (*Sturnella neglecta*)
*Eastern Red-wing (*Agelaius phoeniceus phoeniceus*)
Rusty Blackbird (*Euphagus carolinus*)
Brewer Blackbird (*Euphagus cyanocephalus*)
*Eastern Cowbird (*Molothrus ater ater*)
Eastern Purple Finch (*Carpodacus purpureus purpureus*)
*Red-eyed Towhee (*Pipilo erythrophthalmus erythrophthalmus*)
*Eastern Goldfinch (*Spinus tristis tristis*)
*Pale Goldfinch (*Spinus tristis pallidus*)
*Churchill Savannah Sparrow (*Passerculus sandwichensis oblitus*)
*Leconte Sparrow (*Passerherbulus caudacutus*)
*Eastern Vesper Sparrow (*Pooecetes gramineus gramineus*)
*Slate-colored Junco (*Junco hyemalis hyemalis*)

*Eastern Field Sparrow (*Spizella pusilla pusilla*)
*Western Field Sparrow (*Spizella pusilla arenacea*)
*White-throated Sparrow (*Zonotrichia albicollis*)
*Eastern Fox Sparrow (*Passerella iliaca iliaca*)
*Mississippi Song Sparrow (*Melospiza melodia beata*)

SUMMER VISITANTS

Birds occurring only in summer are placed in this group.

Eastern Green Heron (*Butorides virescens virescens*)
*Yellow-billed Cuckoo (*Coccyzus americanus americanus*)
Cherrie Nighthawk (*Chordeiles minor aserriensis*)
*Chimney Swift (*Chaetura pelagica*)
*Ruby-throated Hummingbird (*Archilochus colubris*)
*Eastern Kingbird (*Tyrannus tyrannus tyrannus*)
*Scissor-tailed Flycatcher (*Muscivora forficata*)
*Northern Crested Flycatcher (*Myiarchus crinitus boreus*)
Acadian Flycatcher (*Empidonax virescens*)
Eastern Wood Pewee (*Myiochanes virens*)
*Purple Martin (*Progne subis subis*)
*Blue-gray Gnatcatcher (*Polioptila caerulea caerulea*)
*Northern White-eyed Vireo (*Vireo griseus noveboracensis*)
*Red-eyed Vireo (*Vireo olivaceus*)
Yellow-throated Vireo (*Vireo flavifrons*)
Eastern Yellow Warbler (*Dendroica aestiva aestiva*)
*Western Parula Warbler (*Compsothlypis americana ramalinae*)
Maryland Yellow-throat (*Geothlypis trichas trichas*)
Yellow-breasted Chat (*Icteria virens virens*)
Orchard Oriole (*Icterus spurius*)
*Summer Tanager (*Piranga rubra rubra*)
Indigo Bunting (*Passerina cyanea*)
*Painted Bunting (*Passerina ciris ciris*)
*Dickcissel (*Spiza americana*)

MIGRANT SPECIES

Birds that migrate through the county in spring and/or fall, but do not nest or winter here, are included in this list.

American Egret (*Casmerodius albus egretta*)
Little Blue Heron (*Florida caerulea caerulea*)
American Bittern (*Botaurus lentiginosus*)
Black-crowned Night Heron (*Nycticorax nycticorax hoactli*)
Yellow-crowned Night Heron (*Nyctanassa violacea violacea*)
Canada Goose (*Branta canadensis canadensis*)
Lesser Snow Goose (*Chen hyperborea hyperborea*)
Gadwall (*Chaulelasmus streperus*)
Green-winged Teal (*Nettion carolinense*)
Blue-winged Teal (*Querquedula discors*)
Cinnamon Teal (*Querquedula cyanoptera*)
*Shoveller (*Spatula clypeata*)
Redhead (*Nyroca americana*)
Canvas-back (*Nyroca valisineria*)
Greater Scaup (*Nyroca marila*)
Lesser Scaup (*Nyroca affinis*)
American Golden-eye (*Glaucionetta clangula americana*)
Buffle-head (*Charitonetta albeola*)
Upland Plover (*Bartramia longicauda*)
*Western Solitary Sandpiper (*Tringa solitaria cinnamomea*)
Greater Yellow-legs (*Totanus melanoleucus*)
Lesser Yellow-legs (*Totanus flavipes*)
Least Sandpiper (*Pisobia minutilla*)
*Tennessee Warbler (*Vermivora peregrina*)
*Southern Parula Warbler (*Compsothlypis americana americana*)
Black and White Warbler (*Mniotilta varia*)

Black-throated Green Warbler (*Dendroica virens virens*)
Blackburnian Warbler (*Dendroica fusca*)
Chestnut-sided Warbler (*Dendroica pensylvanica*)
Wilson Pileolated Warbler (*Wilsonia pusilla pusilla*)
Canadian Warbler (*Wilsonia canadensis*)
Baltimore Oriole (*Icterus galbula*)
*Texas Painted Bunting (*Passerina ciris pallidior*)

VAGRANT

In this category are placed those birds that are of rare occurrence in this county.

*White Pelican (*Pelecanus erythrorhynchos*)
Blue Goose (*Chen caerulescens*)
Red-shafted Flicker (*Colaptes cafer collaris*)
Vermilion Flycatcher (*Pyrocephalus rubinus mexicanus*)
American Redstart (*Setophaga ruticilla*)
*Great-tailed Grackle (*Cassidix mexicanus prosopidicola*)
Bobolink (*Dolichonyx oryzivorus*)

Of the 157 kinds of birds recorded for Brazos County, 40 are permanent residents, 53 are winter visitants, 24 are summer visitants only, and 40 occur in migration or rarely at other seasons. For example, the Great-tailed Grackle, which nests commonly on the

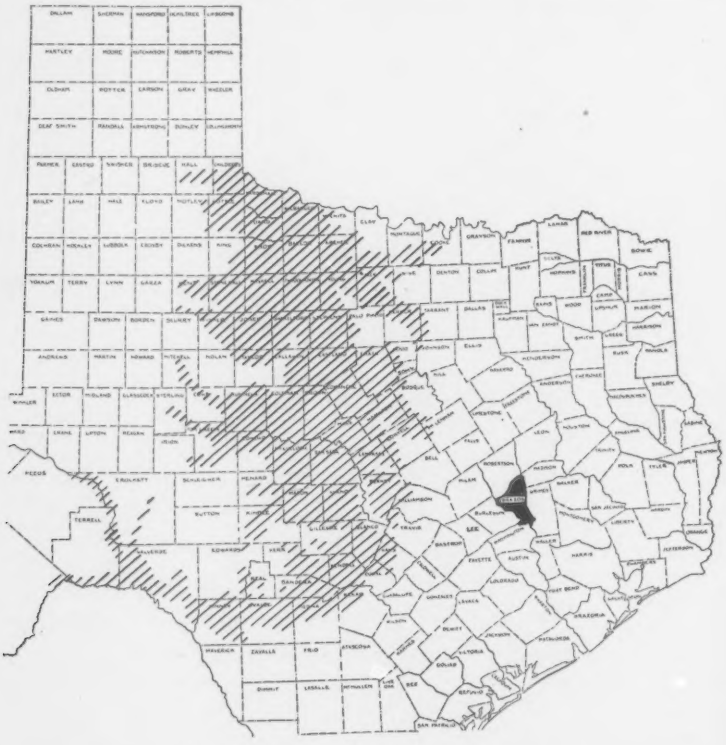


Fig. 23. Map of Texas showing locations of Brazos County (solid black) and "first plateau" (shaded).

coastal plains fifty miles to the south, and the Vermilion Flycatcher, a common breeding bird on the "first plateau" one hundred miles west, occur in the county only for a brief time after the nesting season. Perhaps their occurrence should be attributed to postbreeding wandering.

Analysis of the avifauna of the county reveals that it consists predominantly of eastern and southern forms; slightly more than 8 per cent of the birds are distinctly western. In Kerr County, situated largely on the "first plateau" in central Texas, however, the percentage of western elements is considerably greater. For example, cursory examination of the catalog of specimens in the Texas Cooperative Wildlife Collection reveals that no less than 16 kinds of distinctly western birds breed in that county. In Brazos County the number is 4, whereas in Walker County, some 60 miles east of Brazos County, the number drops to 3. A tabular comparison of the western forms breeding in each of these three counties suggests that the eastern edge of the "first plateau" (see map) marks the eastern limits of the ranges of most of the western birds occurring at this latitude in Texas. Toward the north, the plateau swings eastward, thus probably accounting for the occurrence of several western birds in Dallas County (see Stillwell, Check-list of birds of Dallas County, Texas, 1939).

WESTERN BIRDS FOUND BREEDING IN KERR, BRAZOS, AND WALKER COUNTIES, TEXAS
(LATITUDE 30° — 31° N)

Kerr County	Brazos County	Walker County
Western Mourning Dove	Western Mourning Dove	Western Mourning Dove
Road-runner	Road-runner	Road-runner
Western Lark Sparrow	Western Lark Sparrow	Western Lark Sparrow
Western Turkey Vulture	Western Turkey Vulture	.....
Ladder-backed Woodpecker	.....	.....
Ash-throated Flycatcher	.....	.....
Western Wood Pewee	.....	.....
Vermilion Flycatcher	.....	.....
Bush-tit	.....	.....
Bewick Wren	.....	.....
Canyon Wren	.....	.....
Western Mockingbird	.....	.....
Long-tailed Chat	.....	.....
Bullock Oriole	.....	.....
Western Blue Grosbeak	.....	.....
House Finch	.....	.....
Western Chipping Sparrow	.....	.....

It seems worthwhile to compare the bird population of Brazos County, 30° N, with that of Bannock County, Idaho, 43° N (Davis, Condor, vol. 37, 1935, pp. 233-238), to bring out the effect of latitude and other factors of geographic position on seasonal composition.

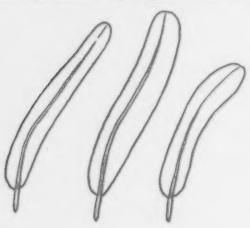
Classes	Brazos County Texas		Bannock County Idaho	
	Number	Per cent	Number	Per cent
Permanent residents	40	25.5	35	22
Summer visitants	24	15	91	56
Winter visitants	53	34	11	7
Migrants	40	25.5	24	15
Total	157		161	

In Idaho the majority of birds are summer visitants, whereas in Texas winter visitants constitute the largest class. Actually, the number of species and individual birds in Brazos County is lower in summer than it is in winter. The reverse is true in the northern states.

Department of Fish and Game, Agricultural and Mechanical College of Texas, College Station, Texas, October 30, 1939.

FROM FIELD AND STUDY

The Dive Note of the Anna Hummingbird.—To watch a male Anna Hummingbird (*Calypte anna*) make a "power dive" is a common but always thrilling experience to bird observers. Usually the dive is executed near or over a mate or an intruder. Hunt described the character of the dive in 1920 (Condor, vol. 22, pp. 109-110, fig. 27). The ascent before the dive usually is accompanied by vocal notes fittingly described as *"zeezy-zeezy-zeezy-zee"* by Grinnell and Storer (Animal Life in the Yosemite, *1924, p. 353). In the steep drop of the dive no sound is made, but the instant the bird turns upward,* a sharp note is produced. Various writers have described this note as ***kilp, plip,*** and ***speek.*** The origin of this note has been the subject of considerable speculation. However, the consensus of opinion is that it is produced by flight or tail feathers.



a *b* *c*

Fig. 24. Ventral side of outermost (*a*) and next to outermost (*b*) tail feathers of adult male Anna Hummingbird; *c*, outermost feather of juvenal male. All from left side of tail.

Assuming this to be correct, I conducted a series of experiments with various feathers. Individual feathers and whole tails and wings were held in a swift current of air. The only promising response in these tests came from outermost tail feathers, which are narrower than the others (fig. 24). Then, in an effort to duplicate the conditions at the bottom of the dive, I attached an outer tail feather to a slender strip of bamboo. By whipping this through the air a note was produced, which was almost identical with that produced by the bird. No other feathers produced this note. This experiment was demonstrated before the Cooper Club at its annual meeting in Fresno, on April 16, 1938.

In the autumn of 1939, it was called to my attention that some Anna Hummingbirds, presumably immature males, were executing the dives but were not producing the note. I have since watched the performance, and, although the dives were usually not as steep as those of the adult male, some of them should have produced the note had the character of the dive alone been responsible for its production. To ascertain if the absence of the note might be due to lack of properly shaped outer tail feathers, museum specimens were examined. It was found that the outer tail feathers of juvenal males are broader, especially toward the tip, than those of the adult (fig. 24), and have a softer vane. I was unable to produce the note with these feathers on the bamboo whip.

Thus, the note at the bottom of the dive of the adult male Anna Hummingbird is apparently produced by the vibration of the outer tail feathers, and although young males still in juvenal plumage may execute the dive, their outer tail feathers are not fitted to attain the vibrations necessary to produce the note.—THOMAS L. RODGERS, *Museum of Vertebrate Zoology, Berkeley, California, October 21, 1939.*

Starlings Arrive in the Rio Grande Valley of New Mexico.—On November 3, 1939, at about 5 p.m., Mr. Luna Leopold and I saw seven Starlings (*Sturnus vulgaris*) one mile east of the Rio Grande and five miles north of Albuquerque, Bernalillo County, New Mexico. While driving slowly, we first saw three starlings, followed promptly by another group of three, all flying east. We stopped the car and, while watching the disappearing birds through binoculars, a lone starling flying west passed directly overhead and not more than one hundred feet above us. This observation provides the first record of the starling in the Rio Grande Valley of New Mexico. Starlings were seen again in the same locality on November 12 when four were observed as they foraged with several meadowlarks in an alfalfa field. They were wary and would not permit me to approach near enough to obtain a specimen. On November 26 in an alfalfa field twenty miles south of Albuquerque a flock of thirty starlings was seen foraging with a much larger flock of Red-winged Blackbirds. Two of the starlings were collected.

The small farms and the many old cottonwood trees along the Rio Grande should provide suitable environment for starlings. Their spread up and down this valley, which extends the full length of the State, will be interesting to follow. Starlings have been recorded in the eastern part of New Mexico at Texico on March 7 and at Clovis on March 7 and 8, 1939, by P. S. Allan (Condor, vol. 56, 1939, pp. 477-478).—A. E. BORELL, *Soil Conservation Service, Albuquerque, New Mexico, November 30, 1939.*

The Second Year of the Pacific Gull-Banding Project.—In the project sponsored by the Western Bird-Banding Association to study gull migration and life history, 4000 nestling gulls of three species have been marked to date. Each bird bears two colored celluloid bands and a Biological Survey band. In the summer of 1939, young of the seven colonies of 1938 were again distinctively banded, and a new colony at Great Salt Lake, Utah, was added. Color combinations used are as follows:

Colony	1938		1939	
	right leg	left leg	right leg	left leg
1. *N. Coronado Island, Mexico* (off San Diego, Calif.): Western Gulls (*Larus occidentalis wymani*). Banders: Grace Sargent, David Michener, William Webb, Harold Hill, Thomas Miller, Fred Gallup.	Red Survey Red		 Red Red	 Survey
2. *Mono Lake, California:* California Gulls (*Larus californicus*). Bander, Walter Nichols.	Blue Survey	 Blue	Survey Blue	 Blue
3. *Three Arch Islands, Oregon:* Western Gulls (*L. o. occidentalis*). Bander, Reed Ferris.	 Survey	 Red Blue	Blue Survey Red	
4. *Haystack Rock, Oregon:* Western Gulls. Bander, Reed Ferris.	 Blue	 Red Survey	Red Survey Blue	
5. *Mittlenatch Island, Gulf of Georgia, B. C.:* Glaucous-winged Gulls (*Larus glaucescens*). Bander, Theed Pearse.	Yellow Survey	 Yellow	Yellow Yellow	 Survey
6. *Yellow Island, Haro Straits, B. C.:* Glaucous-winged Gulls. Bander, Dennis Ashby.	Yellow Blue	 Survey	Blue Yellow	 Survey
7. *Gull Island, Howe Sound, B. C.:* Glaucous-winged Gulls. Bander, Kenneth Alexander.	 Yellow Survey	 Blue	Yellow Survey Blue	
8. *Great Salt Lake, Utah:* California Gulls. Bander, A. M. Woodbury.			Red Survey	 Yellow

Many reports are being received on the movements of these young gulls, but since the birds are not yet adult, much still remains to be learned. Every bird student can help the project by watching for these gulls. If a color-banded bird is seen, report the exact color combination, date, and place, and your name to the address below. If a bird is found dead, also send the Survey band to the Biological Survey, Washington, D. C.—GRACE TOMPKINS SARGENT, *Chairman, Pacific Gull Project, Scripps Institution, La Jolla, California, November 1, 1939.*

An Ancient Nesting Site of the White Pelican in Nevada.—To look down from the mountain on a straight white line of pelicans gliding over the intensely blue waters of Pyramid Lake, rimmed round by a gleaming band of alkali, is to see these birds to good advantage. Then to look beyond into the afternoon's haze, and back again at the vividly clear picture of these soaring birds, whose white cloaks, with jet black cuffs, are surmounted by unbelievably grotesque, orange head dresses, like the long-nosed masks of aboriginal witch doctors, leads almost any imaginative observer to speculate, with a certain reverence and humility, on the innumerable years that have elapsed since the first big birds of their kind found secure haven here in the ancient desert. Then, as now, they must have sought some island on which to nest. The watcher muses and his eyes mark, one after another, low mountain tops that in centuries past barely protruded above Quaternary Lake Lahontan of which Pyramid Lake is but a remnant.

Although on a few of these eminences I have looked, in a casual sort of way, for evidences of the use that I suspected once was made of them, never did I see proof thereof until May 7, 1939, when Miss Laura Mills showed me bones and egg shells of pelicans in a deposit on Rattlesnake Hill at Fallon, Nevada.

With the aid of Messrs. J. R. Alcorn and Vernon Mills, and their wives, we recovered about a gallon measure of bones. Roughly three out of four were those of the White Pelican (*Pelecanus erythrorhynchos*), more than half of them from immature birds. The remaining bones were mostly of adult Double-crested Cormorants (*Phalacrocorax auritus*), although one bone of a Canada Goose (*Branta canadensis canadensis*) was found, and there were many bones of fishes of several sizes and of more than one species. The bones are fragile, and some seem to be partly fossilized; minerals from the enveloping sediments appear to have replaced some of the original substance of the bone. About a third of the bones are more or less water worn. The egg shells all are in fragments whose curvature and texture suggests that they were laid by pelicans and not cormorants.

Contemplation of these remains recalls to mind one colony of White Pelicans that in 1924 nested on the low, gravelly, northeastern arm of Anaho Island in Pyramid Lake (Condor, vol. 27, 1925, pp. 147-160); that colony could have provided an assemblage identical with the one at Rattlesnake Hill. There, on Anaho Island, innumerable fish, discarded by the pelicans, lay about in the colony which extended down to within a dozen steps of the water's edge. Every day, cormorants came to sit on four low, partly submerged rocks, and once sixteen Canada Geese swept past my blind, alighted on the gravel bar, and waddled by the evenly spaced White Pelicans, each patiently at its appointed task of incubating two white eggs. In the ensuing weeks, dozens of short-lived young pelicans, and an occasional adult pelican and cormorant, died there. At this very time one had only to drag his boot through the sand to uncover bones left by deceased members of the previous years' nesting colonies.

At other places—places far removed from any nesting colony—remains accumulate on the shore of Pyramid Lake that resemble those on Rattlesnake Hill. These places are where pelicans consort with cormorants for resting. Toward the beginning of the nesting season some of these pelicans, and more rarely cormorants, deposit isolated eggs in the shallow water, and the eggs, in time, are covered by sand.

Nevertheless, the large number of fragments of egg shells and the high percentage of bones of young birds in the deposit at Rattlesnake Hill make me think that it was the site of an actual nesting colony. Supposing it to have been on a low bar of gravel and sand, like the colony referred to on Anaho Island, wave action, following a slight rise in the water level, would have imparted to many bones the same water-worn character as have about a third of those at Rattlesnake Hill.

Fig. 25. Rattlesnake Hill, Fallon, Nevada, showing horizontal calcareous stratum beneath which bones were found. Photo by Laura A. Mills, September 23, 1939.

The bones and egg shells were in an eight-inch stratum of sand and slightly water-worn gravel, conformably overlain by a hard calcareous deposit about five inches thick. This is capped by four to six feet of sediments varying in nature from place to place. The two underlying strata appear to extend through the entire hill; certainly both are present at each of the widely separated places where excavations have been made to obtain sand and gravel used in paving the streets of Fallon. By reason of the generous measure of bird bones which went into the construction of its thoroughfares, the town, ornithologically, has a rare, and perhaps unique, distinction.

Rattlesnake Hill is on the northeastern edge of the town of Fallon, Churchill County. As may be seen on the Carson Sink Quadrangle (1910 edition of the U. S. G. S. topographic series), the hill rises a little more than 200 feet above the level of the surrounding basin. The top of Rattlesnake Hill, which is less than 4300 feet above sea level, may have been completely covered by the waters of Lake Lahontan when they reached their highest level of about 4400 feet. Although the water-formed calcareous layer above the bones proves that they were under water at least once, I do not know if this was before, at, or after, the time when Lake Lahontan attained its maximum level. This time has been variously estimated at from as little as five hundred years to as much as several hundred thousand years ago. Whenever that may have been, the nesting colony was occupied long before white men knew the place and our information goes to show that the avian associates of the White Pelican then were about the same as they are now at nearby Pyramid Lake.—E. Raymond Hall, *Museum of Vertebrate Zoology, University of California, Berkeley, October 30, 1939.*

Shrike Captures Bat.—On July 27, 1939, at Daylight Pass, Death Valley National Monument, California, a small bat, probably the little pallid bat (*Myotis californicus pallidus*), was seen flying in an easterly direction at a height of from six to ten feet. The hour was approximately 6:45 a.m. The sun had barely emerged from behind the low ranges in adjacent Nevada, but already on the open desert the light was bright enough for photographic snap shots. The writer had just time for a mental note that the hour was phenomenally late for a bat before the latter paid the penalty for this departure from the normal behavior pattern of its species. Suddenly a Loggerhead Shrike (*Lanius ludovicianus nevadensis*) darted from the sagebrush, quickly overtook the wavering night flier and nabbed it as a flycatcher nabs a moth. The two slanted earthward, locked in a violent struggle, but hardly had they touched the ground before the shrike rose again and with the bat now fluttering only feebly as it hung from his bill, sped away in triumph. The average weight of nineteen specimens of the related and but slightly larger *Myotis lucifugus carissima* collected by the writer in previous years is 6.2 grams; seven shrikes of the *ludovicianus* group averaged 46.5 grams.—E. Lowell Sumner, Jr., *National Park Service, San Francisco, California, November 21, 1939.*

Notes on the Birds of Crater Lake National Park, Oregon.—While at Crater Lake National Park, Oregon, from June 1 to September 4, 1939, some changes in the avifauna were noted in comparison with that of the preceding summer season. Although few new species were found, the numbers of some were either notably increased or decreased. A factor which might have affected many birds was the advanced condition of the season. It was estimated, according to the amount of snow on the ground, that the season was about one month in advance of normal. Nesting, however, seemed to be advanced only about two or three weeks, as judged from dates of nests of the following species: Rufous Hummingbird, Red-shafted Flicker, Hairy Woodpecker, Red-breasted Nuthatch, Mountain Bluebird, Rosy Finch, and Chipping Sparrow.

One prominent difference was the increased abundance of certain waterfowl occurring on the lake. Crater Lake, which is geologically relatively young, does not afford a variety of habitats for water birds. In this respect it is quite different from Upper Klamath Lake, about fifty miles distant, which supports a dense waterfowl population. Because Crater Lake water is relatively pure, with only about eighty parts per million of dissolved salts, it does not sustain luxuriant aquatic vegetation. There are few shoals with muddy bottom which can support such plants as tules or sedges. Most of the shore is steep and boulder covered, and the cliffs continue nearly vertically below the surface so that at a distance of fifty yards off-shore the water may be as deep as 500 feet. The lake does, however, support a good population of rainbow trout and silverside salmon that is maintained by annual plantings. The fish reproduce very little if at all, probably because of lack of spawning beds (Hasler, Jour. Wildlife Management, vol. 2, 1938, pp. 94-103). Their diet is largely made up of various invertebrates such as insects, snails, worms, and certain crustaceans such as *Daphnia*, which at certain times of the year constitutes nearly half of the fishes' diet. These invertebrates may also be utilized by some of the waterfowl. It is believed, however, that the most common water birds, such as the Double-crested Cormorant (*Phalacrocorax auritus*), American Mergansers (*Mergus merganser americanus*), and gulls feed largely on fish. By comparison of recorded numbers with records of last year it is evident that birds of these species were nearly twice as abundant this year as previously.

This increase in fish-eating waterfowl may be due directly to a disease which affected some of the fish or to an increase in the fish of a certain age group, or both. The problem of the disease is not solved as yet but it is certain that it is a species of water mould (*Saprolegnia*). The infection apparently is specific in its attack and only the silverside salmon that are about five inches long and between two and three years of age are bothered; none of the rainbow trout was so affected. *Saprolegnia* causes a light-colored, ragged sore on the dorsal surface of the fish between the dorsal fin and the head, and sometimes slightly behind this fin. Ordinarily the dark color of the dorsal surfaces of the fish renders them practically invisible against the extremely deep blue of the water, but with the *Saprolegnia* on them their protective coloration is gone. This makes them very easily seen, even from the cliffs 1000 feet above. Cormorants, while flying over, were several times seen to swerve suddenly in their course and alight amidst a school of diseased fish. This sudden change in course while flying was never observed the year before. From the rim above the lake surface it was interesting to watch with binoculars the cormorants diving into a school of fish, and at times, see them chasing one fish until it was caught. No use of the wings under water was noted.

Not only were the fish of this age group that was parasitized more sluggish and thus more easily caught, but they seemed more abundant. Many times large schools of such fish were seen close to the surface where they made the water seemingly boil with their movements. The roosting and probable

nesting site of the greatest number of cormorants was on the island known as Phantom Ship where as many as 54 were counted at one time, some perching on the coniferous trees as well as the rocky crags. Many immatures were observed later on in the summer season.

The schools of diseased fish provided food for the California Gulls (*Larus californicus*) and American Mergansers, and a few Ring-billed Gulls (*Larus delawarensis*). The gulls probably fly in from Klamath Lake and most of them leave before nightfall. Some days they may be seen in a large flock flying in circles high above the center of the lake. They hunt singly or in flocks and may be seen dipping into a dense school of fish that is swimming close to the surface. The American Mergansers are believed to be transients and the largest number seen in one day was fourteen, which was more than seen by me last year.

Also connected with the fish problem was the presence this year of more Ospreys (*Pandion haliaëtus*) than usual. Although no nests were found, the birds were seen about ten times throughout the summer and were observed to be chased by Bald Eagles (*Haliaeetus leucocephalus*) which made them drop their prey.

Other raptors also were more abundant. Two probable nesting ledges of the Duck Hawk (*Falco peregrinus anatum*) were found on the crater wall and later in the season one adult and two young were seen maneuvering together near Pumice Point. Two possible nesting ledges of the Prairie Falcon (*Falco mexicanus*) were found on the northeast crater wall, and in August one bird of this species used as a perch a tree above the Sinnott Memorial beneath which there was a concentration of people. The movement of people below seemed not to bother the activities of the falcon and twice it was seen to make unsuccessful stoops at golden-mantled ground squirrels.

Noticeable was the decided decrease in Red Crossbills (*Loxia curvirostra*). In the summer of 1938, crossbills came in great numbers to the rim area coincident with the maturing of the cones of the white-bark pines and mountain hemlocks. This year there were relatively few mature cones of the white-bark pine, which cones require two years to mature. By census counts, crossbills were much more abundant in 1938 than in 1937 and 1939. Only three small flocks and occasional solitary individuals were seen in 1939. These were seen to feed on cones of the mountain hemlock which mature in one year and which were as abundant as ever, but it is believed the ripe cones of the white-bark furnish a more desirable source of food for crossbills. The factor of cone production as a cause for the erratic distribution and variation in nesting times of the Red Crossbill has recently been reviewed by Griscom (Proc. Boston Soc. Nat. Hist., vol. 41, 1937, p. 82).—Elmer C. Aldrich, *Oakland, California, November 2, 1939.*

The Osprey in New Mexico.—The Osprey (*Pandion haliaëtus*) is an uncommon bird in New Mexico; it has been reported from only ten localities in Dona Ana, Grant, Catron, Chavez, Taos, and San Miguel counties (F. M. Bailey, Birds of New Mexico, 1928, pp. 184-185). With exception of two records from Taos and San Miguel counties, these are all from the southern half of the State. In view of this relative scarcity it is desirable to report the following observations.

At about 11:00 a.m. on April 23, 1936, one was seen at Mariana Lake, Mariana Lake Trading Post, McKinley County. It was perched on the top of a telephone pole near the water, at the west end of the lake, and was eating a fish. At the time of this observation Mariana Lake held considerable water and provided fair sport fishing for bass, blue-gill, and catfish. Because of drouth, silting, and excessive growth of cattails, the lake has since become much reduced in size. To the best of my knowledge this is the first record of this species on the Navajo Indian Reservation.

A dead Osprey was found on October 24, 1937, wired to the top west girder of the Alameda Bridge over the Rio Grande, one and one-quarter miles west of Alameda, Bernalillo County. The bird was in a relatively fresh condition, possibly dead no more than one or two days. Although one cannot be certain, it is possible that this Osprey was shot along the Rio Grande, somewhere in the general vicinity of the Alameda Bridge.

On the afternoon of September 18, 1939, an Osprey was seen at Caballo Dam, Sierra County. It was perched on top of a telephone pole beside the main highway, west of the dam. The bird flew from its perch as our car approached and it was then seen to be carrying a fish about eight inches long. Caballo Dam is on the Rio Grande and was completed in September, 1937; the lake that is now forming behind it provides an enlarged habitat for this bird. The Rio Grande at this point contains bass, blue-gill, catfish, carp, and chub.

Mr. A. E. Borell of the Soil Conservation Service at Albuquerque, New Mexico, has provided the following observation: "In late afternoon of September 19, 1938, an Osprey was seen perched on a telephone pole near a playa lake, twenty-three miles southwest of Hatch, Luna County. Flood waters had made a large shallow pond in an area where there usually is no water."—Lawrence V. Compton, *Soil Conservation Service, Albuquerque, New Mexico, September 28, 1939.*

DEDICATION

With the deepest respect and feeling, the Cooper Ornithological Club dedicates this issue of the Condor to the memory of Joseph Grinnell. Several of his students have joined to contribute the non-biographical content of this number.

Much of the story of Grinnell's life has been told in preceding pages, but there is yet to be related one phase of his accomplishments which can best be appreciated by those who in late years embarked upon scientific investigation under his guidance. This was his unselfish sponsorship and encouragement of the young investigator. For many years Joseph Grinnell pursued his own research and writing with boundless energy; the attention of his inquisitive mind seemed completely absorbed with his prodigious program of work. But in the last two decades of his life concern for the beginners in his fields of interest grew strongly. Tolerance and understanding of young persons became an outstanding quality and he spent time without limit in diligent coaching of those who might carry on after his day.

His method with the beginner rested on the sound principle of teaching by example. There was always the stimulating sight of Grinnell enthusiastically studying and putting through a new piece or research. We were allowed, often in subtle fashion, to see how he worked. Seldom were we told what to do unless we asked, and perhaps not even then, but at every turn there was opportunity to see his system, to sample his critical viewpoints, and to note the safeguards he used to insure soundness of scientific results. Grinnell seemed not so much interested in making research workers as in seeing what ability would naturally develop in a good environment. He wished to see what new viewpoints a fresh unprejudiced mind could engender.

He was heard to say many times that the original thoughts and constructive research of any person will come to light early in his life. It is a mistake for oldsters to dominate the field. They are through as regards progressive investigation. He urged them to step aside that the young men might develop their work without domination or discouragement and before their working days are impinged upon by responsibilities that do not contribute to the fund of human knowledge. It is easy to understand how such an attitude forged a strong bond with the student and spurred the beginner to do his best to merit this confidence.

The criticism of oldsters Grinnell must seriously have applied to himself in shaping his actions and thoughts, for he remained to the last remarkably young in mind. Students found in him a kindred spirit, one willing to lay aside old interpretations and to adopt new lines of thought which might contravene his own earlier writings. His authoritative judgment was all the more sound because he could view objectively his own work.

A device to which he habitually resorted in drawing out a student was questioning with all semblance of being entirely ignorant of the answer himself. Often he had written something on the subject in one of his many papers, but it was left to the student to discover this at some later date.

The crucial stage in guidance of a young investigator came in examination of the student's manuscripts. Here were the tangible results of study, embodying the final judgment of the researcher. How patiently he read over with us our first papers, criticising usage and challenging every thought! In order to promote this phase of instruction he conducted an informal class in scientific writing and technique of publication, but this in no way replaced the individual attention that students' papers received.

We hold the warmest admiration for the way Joseph Grinnell grew in outlook, knowledge and understanding with the fields of science and the institutions which he helped so importantly to build. His students and associates pay tribute to his democratic and inspiring leadership.—ALDEN H. MILLER.

NOTES AND NEWS

The Fourteenth Annual Meeting of the Cooper Ornithological Club has been scheduled for March 22 and 23 in the Los Angeles area. Already a committee of members is active there in planning for the program. In a short time contributors to the scientific sessions will be asked to submit titles and it is hoped that many persons will be prepared to respond. Owing to previous meetings in Berkeley and Fresno and the postponement of a meeting last year in order to serve as hosts to the American Ornithologists' Union in California, four years will have elapsed since the Club as a whole last convened in southern California. We welcome the opportunity to meet there once more.—A. H. M.

The index to Volume XLI of the Condor was prepared by Virginia D. Miller. The Club is indebted to her for this assistance in making more accessible the material in the Condor.

MINUTES OF COOPER CLUB MEETINGS

Southern Division

September.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum, Exposition Park, on Tuesday, September 26, 1939, at 8 p. m., with 25 persons present and Mr. Peyton presiding.

The minutes of the Southern Division for August were read and approved. Four applications for membership were read as follows: Bernard Alpert, 170 Broadway, New York, N. Y., and Mitchell Tabb Neff, Kentfield, Marin Co., California, both proposed by W. Lee Chambers; Philip Farley Allan, 806 Bellview Street, Amarillo, Texas, by L. V. Compton; and Paul David Hurd, Jr., P. O. Box 533, Costa Mesa, California, by Mrs. N. Edward Ayer.

Mr. Platford introduced Mr. A. W. Elder of the Biological Survey, a visitor for the evening. There being no scheduled program, the meeting was turned over to informal discussion.

Interest centered around Mr. Pemberton's and Mr. Harrison's observations in the Condor country. It was noted that Ravens are first on the scene in the early morning, the Condors waiting until three hours after sunrise before starting their day's activities. The Ravens feeding on a carcass make way for the Condors as they arrive, although they return to take what tid-bits can be had around the edges.

Upon being questioned as to the possibility of banding the young Condors, Mr. Pemberton indicated that this had already been done, using very heavy, large, metal bands, which, however, have been so mutilated by the pecking of the birds as to be practically unidentifiable.

Three excellent enlargements from Mr. Pemberton's color motion picture film of individual Condors were put on display.

Other observations included Mr. Ed Harrison's report of having recently seen five Ospreys, four at Encinitas and one feeding in a slough north of Oceanside, although the birds were all seen at different times and on different days, Mr. Harrison seemed confident that he was not merely seeing one bird five times.

Adjourned.—Hildegarde Howard, *Secretary.*

Northern Division

October.—The regular monthly meeting of the the Northern Division of the Cooper Ornithological Club was held on Thursday, October 26, 1939, at 8:00 p.m., in room 2503 Life Sciences Building, Berkeley, with President Emlen in the chair and 48 members and guests present. Minutes of the Northern Division for September were read and approved. Names proposed for membership were: Robert Holdenried, Glenn, Glenn County, California, by Susan E. Chattin; Henry A(rthur) Hjersman, 178 Vernon Terrace, Oakland, California, by Thomas L. Rodgers.

B. C. Cain, Chairman of the Conservation Committee, stated that he had been assured that the small, natural pond in the Berkeley Aquatic Park would never be devoid of water, because of its value to the nearby broadcasting station.

Field notes were opened by some amusing excerpts from letters received from falconers by R. M. Bond. Laidlaw Williams gave dates of arrival for a number of species on the Monterey Peninsula. Mr. Joseph Dixon chalked up one point in favor of the English Sparrow, having seen three adults rapidly consuming termites.

The speaker of the evening, Mr. Ben Glading, of the U. S. Forest Service, spoke on the quail studies carried on at the San Joaquin Experimental Range in Madera County, California. Inventories are taken by individual covey counts, by an ingenious horseback method for covering large areas, or by roost counts. Color banding facilitates study of individuals and groups, revealing covey interrelationships and seasonal movements. In addition, sex and age ratios and seasonal variations in the weights of individuals are ascertained. Blood samples reveal 100 per cent infection with quail malaria (*Haemoproteus lophortyx*), which may be of serious consequence from the standpoint of game management, although it bears no relation to the human malarias. Predation is largely accounted for by hawks and ground squirrels. Questions stimulated by Mr. Glading's talk were answered at the close of the meeting.

Adjourned.—Frances Carter, *Recording Secretary.*